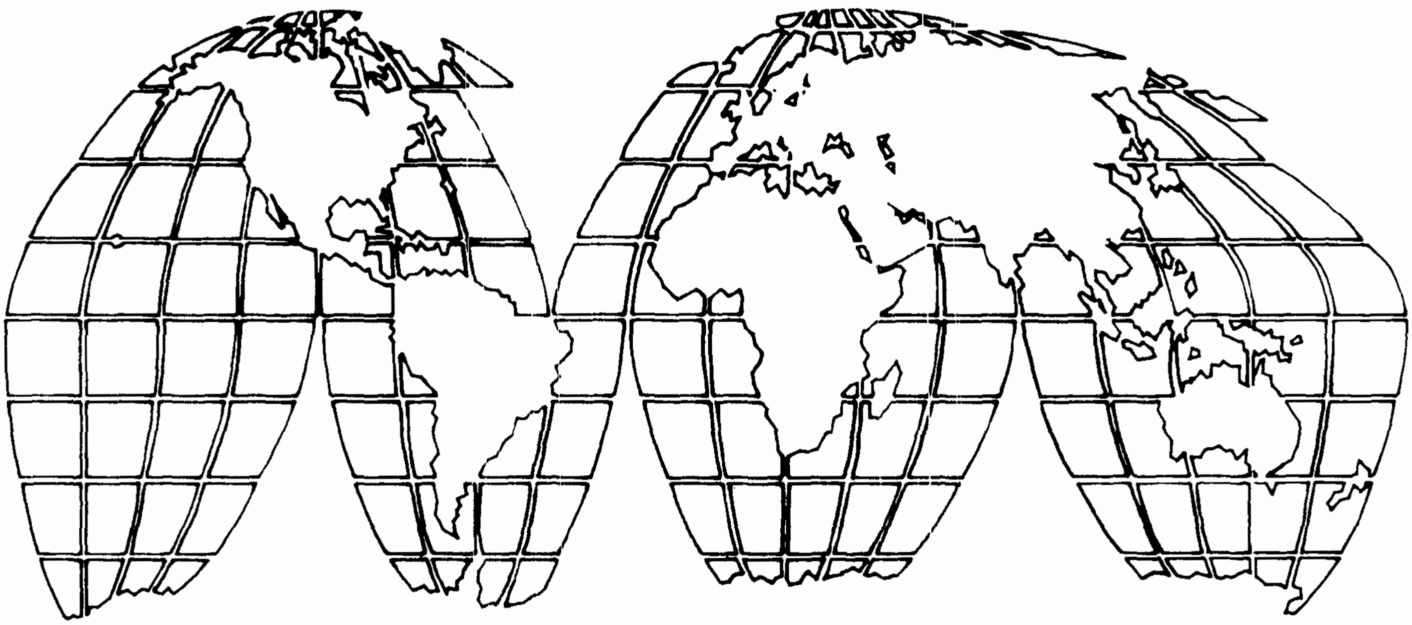
A.I.D. Program Evaluation Report No. 7

Community Water Supply In Developing Countries: Lessons From Experience



September 1982

U.S. Agency for International Development (AID)

PN-AAJ-624

COMMUNITY WATER SUPPLY IN DEVELOPING COUNTRIES: LESSONS FROM EXPERIENCE

EVALUATION SUMMARIES AND CONFERENCE FINDINGS

A.I.D. Program Evaluation Report No. 7

by

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September 1982

The views expressed in this paper are those of the author and the conference panels. They do not represent the views of the Agency for International Development.

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FOREWORD

Water is a fundamental requirement for human survival. Poor people in poor countries, women and children especially, spend countless hours and considerable energy finding and securing it. The fruits of their efforts remain limited and often of low quality. Health is endangered, time is wasted, and the margin for more productive human endeavor is very thin. Improving access to more reliable, convenient, and safer sources of water is a major objective of most less developed countries--and it has been a sector of major assistance for years. During the 1960s and 1970s, AID, often in collaboration with private voluntary organizations, developed many projects. Some of these have been clear successes--some less so. The Agency is not immune to the general concern for the viability and long-term development impact of its water projects. Faced with increasingly severe budget constraints, questions began to be raised about the wisdom of these projects, whether our post experience indicated success, and whether there was anything to be learned by most development agencies from that experience for future programs and policies.

The Agency for International Development has been an important contributor to LDC efforts to provide improved water supplies to rural residents over the past 20 years. Yet, efforts to improve water supplies to rural areas especially have been the subject of much criticism and, in spite of rhetoric, declining interest by donors. Anecdotal and systematic evidence has been advanced to indicate that much of the expenditure has been wasted, that many of the systems no longer operate, or that these systems are too expensive relative to the benefits.

In 1979, the Office of Evaluation, Bureau for Program and Policy Coordination, was assigned the task of conducting a review of AID's experience. This report summarizes that three-year effort.

I urge readers to pay careful attention to the findings and recommendations contained in this report. The intent of this evaluation effort was to improve the Agency's effectiveness through a synthesis of experience. It is hoped that five years from now, it will be demonstrated that the Agency has indeed "learned" to be even more effective in its assistance to this important sector.

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ACKNOWLEDGMENTS

Many persons have assisted in the three-year effort to examine the impacts of community water projects in rural areas. Team leaders and members were major contributors and are acknowledged elsewhere. Those whose efforts should be recognized here are Robert Berg, who guided the effort; Richard Blue, who read and commented on innumerable drafts of evaluations and the summary document; Anamaria Viveros-Long, who co-authored an earlier version of this summary; Vic Wehman, who was a patient source of information over the period; Cindy Clapp-Wincek, who was the conference coordinator; and "Monty" Montanari, a cherished critic who supported the effort even when he disagreed with the results.

PREFACE

This report is a summary of an Agency for International Development (AID) Conference on Community Water Supply. The conference was held on January 24-28, 1982 to provide guidance on the planning, implementation, and evaluation of community water projects. Participants were selected for their involvement and experience in water supply development. AID Missions identified host country nationals to attend the conference. Each conference participant was assigned to one of six work groups and completed workshop reports on the following topics:

- Planning, Implementing, and Evaluating Community Water Projects
- Funding and Financing Water Systems
- Utilization of Appropriate Technology
- Assessing and Affecting Institutional Capability
- Developing Systems that Communities Value
- Determining Appropriate Components for Water Systems

The conference participants were provided with the results of field evaluations on seven countries covering 15 projects funded by AID and other donors, and with a summary of the evaluations. Participants were asked to extend the data base provided by the evaluations through their own personal experience.

I. SUMMARY OF COMMUNITY WATER SUPPLY CONFERENCE RECOMMENDATIONS

The conference submitted the following key recommendations in support of the development of community water supplies. These recommendations should be considered as an adjunct to the "Health Policy Paper: Water Supply and Sanitation."

A. Expanding the Resource Base

AID recognizes the multiple benefits of water supply and sanitation projects and allows the funding of projects from the Food and Nutrition Account (FAA, Section 103) as well as the Health Development Assistance Account (Section 104).

B. Basic Design Objective

Community water supply projects should be designed to provide a reliable and convenient source of water. The quality of water should be addressed within the environmental and social setting with careful consideration of costs and the potential for general replication.

C. Community Financial Support

In preparing community water supply projects, communities should be contacted early in the process to determine the commitment to and value placed on water supply systems. Local users should be willing to support the costs of operations and maintenance of community water supplies. Water projects should be designed to be self-supporting, with some measure of capital recovery if feasible, preferably through direct payment by the beneficiaries or through some form of cross-subsidy. Funds collected for operation and maintenance should remain with the local water organization when feasible.

D. Institutional Support

Water supply projects should provide for strong financial and technical institutions or authorities to oversee construction and establishment of local water systems and which serve as a source of assistance to communities and users associations once they become responsible for on-going operations and maintenance. Wherever possible, existing national, regional, or local institutions should be used; where necessary, new ones should be created.

E. Training

Construction, maintenance and operations training needs should be directly addressed in the project design or be provided for, as necessary, in a specially designed complementary training project. In addition to the traditional concern of training engineers, emphasis should be given to the training of training specialists, administrative staff, managerial staff, and skilled operations and maintenance labor.

F. Sanitation Components

Water supply is generally a higher priority than sanitation for rural communities in developing countries. Inclusion of latrine and excreta disposal, solid waste disposal, wastewater disposal, and drainage components with water supply projects should not be automatic, but depend on the density of the population being served, physical characteristics of the project zone, and per capita water use.

G. Ancillary Components

The inclusion of health education, sanitation, training, institutional development, and income-generating activities in a water supply project should be decided on the basis of needs assessment, feasibility studies, and an indication of community interest and prospects for long-term support.

H. User Education

A user education component may be appropriate for some community water projects, to consist of instructions on use of pump mechanisms and valves, water conservation and notification of proper authorities for system malfunctions. In certain settings (open wells, health hazards from standing water) some health education may be helpful. In these situations, existing education institutions or other alternatives should be considered before undertaking the development of special health education components.

II. COMMUNITY WATER SUPPLY EVALUATION SUMMARY

This section summarizes evaluations of community water supply projects conducted in seven countries over the past three years by the AID Office of Evaluation in an effort to develop and enunciate project design and policy guidelines. It also served as a discussion paper for participants in the International Community Water Supply Conference held in Washington in January 1982, which was the final phase of the evaluation effort that started in mid-1978 and whose conclusions were presented above. At that time, AID was considering an increased level of funding for rural water systems, based on an expected response to the announced United Nations International Drinking Supply and Sanitation Decade, whose aim was to promote universal access to clean water and hygienic waste disposal by 1990. The Office of Evaluation was assigned responsibility for assessing previous projects designed to improve water supply for rural communities.

An Agency-wide working group was chaired jointly by the Office of Evaluation and the Office of Health of the Development Support Bureau. This working group held a workshop on community water supply that was based on issues developed from papers commissioned for the purpose and on discussions within AID. The workshop, attended by experts from AID, other donors, and those active in the field, sought to determine where consensus and disagreement existed. The workshop report listed the conditions that participants agreed tended to make projects succeed or fail as well as and the conditions on which there was no consensus. The report was circulated widely within AID.

The issues raised in the workshop were then tested in the field. Over the evaluation period the emphasis shifted from an examination of all projects, regardless of the donor, to a focus only on AID projects for the balance of the field work. The evaluations were essentially nontechnical, with observation and interviews replacing measurement and water quality testing. The evaluators were interested in whether the systems were working, the users and uses of the system, as well as both reported and observed impacts.

A. Water Supply Background

The purpose of the evaluation of the community water supply[1] sector, begun in late 1978, was to provide evidence of the effect of AID and other donor efforts in that sector. The existing evidence was largely anecdotal and often dealt more extensively with abandoned and rusting hand pumps and unused systems than any evidence of success. As a result, any rapid expansion of the level of funding in response to the United Nations Drinking Water and Sanitation Decade would occur without fundamental guidance and would provide less than maximum effectiveness. To minimize this risk, the lessons from existing project experience would be gathered, analyzed, and used for developing policies for new projects.

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[1]In this paper, the terms "rural water supply" and "community water supply" are used almost interchangeably. "Community supply" is used as the more inclusive term and includes market towns and trading centers. "Rural" applies to nonurban areas. This paper provides no guidance on urban systems.

Achievement of the United Nations' goal of universal access to clean water by 1990 is generally considered unrealistic.[2] However, this is almost incidental to the process which is already underway. While accurate and complete data on the number of persons with access to safe water are not available, the data that are available show that significant progress has been made in developing countries over the last decade. During the 1970 to 1980 period, the percentage of the rural population with access to an improved water supply more than doubled, from 14 percent to 29 percent. Urban areas have not shown the same progress. During this same 10 year period the increase in the percentage of population served was much less dramatic and in the 1975 to 1980 period, the percentage of those in urban areas with access to an improved source of water actually declined (Table 1). The contrast between progress in rural and urban areas on a worldwide basis is reflected in each of the regions; progress was either less rapid in urban areas (Asia) or urban service declined while rural coverage increased (Africa) (Table 2). On a regional basis, the data from a sample of 20 countries reporting in both 1970 and 1980 show improvements in rural Africa and Asia and declines in rural Latin America.

Table 1. Estimated Service Coverage for Drinking Water Supply in Urban and Rural Areas of Developing Countries*
(1970, 1975, 1980)

	1970		1975		1980	
	Population served (millions)	% of total population	Population served (millions)	% of total population	Population served (millions)	% of total population
Urban	316	67	450	77	526	75
Rural	182	14	313	22	469	29
Total	498	29	763	38	995	43

* Excluding Peoples Republic of China

Source: United Nations General Assembly A/35/367, p. 10. (Adapted from A. White and G. White, "Reappraisals and Response to Changing Service Levels," Project Monitoring and Reappraisal in the International Drinking Water Supply and Sanitation Decade, American Society of Civil Engineers, New York, May 1981.)

[2] Current estimates are that at a minimum it will cost $30 billion annually over the decade.

Table 2. Water Supply Coverage for Countries Reporting in 1970 and 1980*
(by region)

Region	Number of countries	1970 Total population (millions)	1970 Water coverage (millions)	1970 Percentage of total population	1980 Total population (millions)	1980 Water coverage (millions)	1980 Percentage of total population	Change in percentage covered
Africa (ECA members)								
Urban	31	63.2	51.8	82	97.0	78.9	81	-1
Rural	24	228.4	41.0	18	293.4	72.2	25	+7
Latin America (ECLA members)								
Urban	18	153.1	115.6	76	212.6	157.8	74	-2
Rural	15	110.6	25.2	23	129.1	27.8	22	-1
Western Asia (EDWA members)								
Urban	9	13.9	13.3	96	22.5	19.7	88	-8
Rural	8	18.0	6.1	34	23.5	6.1	26	-8
Asia and the Pacific (ESCAP members)								
Urban	14	220.5	130.2	59	300.3	209.5	70	+11
Rural	12	737.3	77.6	11	917.3	297.1	32	+21

* The European (ECA members) region countries qualifying for technical assistance under UNDP procedures are not included because only one country reported in both years and the figures listed for 1970 are not consistent.

Source: World Health Organization, World Health Statistics Report 26 No. 11, pp. 724-731, United Nations General Assembly, "International Drinking Water Supply and Sanitation Decade Present Situation and Prospects," 18 September 1980, A/35/367, Annex V. Quoted from Anne U. White and Gilbert F. White. "Reappraisal and Response to Changing Service Levels," Project Monitoring and Reappraisal in the International Drinking Water Supply and Sanitation Decade, American Society of Civil Engineers, New York, May 1981.

1. Donor Assistance to Water Projects[3]

The World Health Organization (WHO) estimates that 1979 expenditures for water supply and sanitation activities in developing countries were $6-7 billion. This includes both developing country costs and donor contributions estimated at $2.4 billion. Among the donors, the World Bank provided the major funding, over $1 billion; regional banks provided $400 million; Commission of European Communities (OECD) bilaterals, $550 million; OPEC countries, $170 million; United Nations, $160 million; and nongovernmental organizations, $100 million.

2. United States Assistance in Community Water Supply

AID's portfolio has changed from its early days. Prior to 1969 the United States provided primarily technological assistance. In 1969, the emphasis in water supply projects shifted from technical assistance to capital assistance. The United States provided development loan funds at low rates of interest, and countries were encouraged to use these funds for larger capital projects. With the increase in capital assistance, country programs less frequently included technical assistance in environmental sanitation activities and water supply projects. Advisory and consultant services in water supply activities to the host countries decreased even though they were badly needed in countries which had not developed adequate local technical capability. Some institutions did fill in when the United States shifted to primarily capital assistance. There was increased technical assistance from the World Health Organization, Pan American Health Organization, and other multilateral agencies, but not enough to overcome the weakness of inadequate local technical capability. While the primary emphasis had changed, the U.S. along with other donors did fund some technical assistance by U.S. engineering firms.[4]

The regional emphasis on water projects has changed. Before 1973, the Latin American Bureau had been the major source of water projects of all sizes. Since then, the Near East Bureau has funded more and larger projects than any of the other regions, using both development assistance and economic support funding. These Near East projects are large urban systems serving major metropolitan areas. The Asia Bureau has also increased its funding from the pre-1980 range while the Africa Bureau has increased projected expenditures and will become the leading AID source of funding for community water supply and sanitation projects.

In recent years, overall funding for water projects through development assistance has declined. Budgets for 1981 and projected for 1982 have fallen substantially from 1980 (Table 3, Figure 1). AID commitment was expected to rise to $250 billion

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[3]Data from General Accounting Office Report, U.S. Strategy Needed for Water Supply Assistance to Developing Countries, Washington: Controller General of the United States, August 25, 1981.

[4]A recent survey indicated that U.S. consultants were involved in overseas water and sewerage projects with an estimated construction cost of over $1.3 billion. See "Financing Overseas Engineering," Consulting Engineer, Vol. 31, pp. 208-218, September 1968.

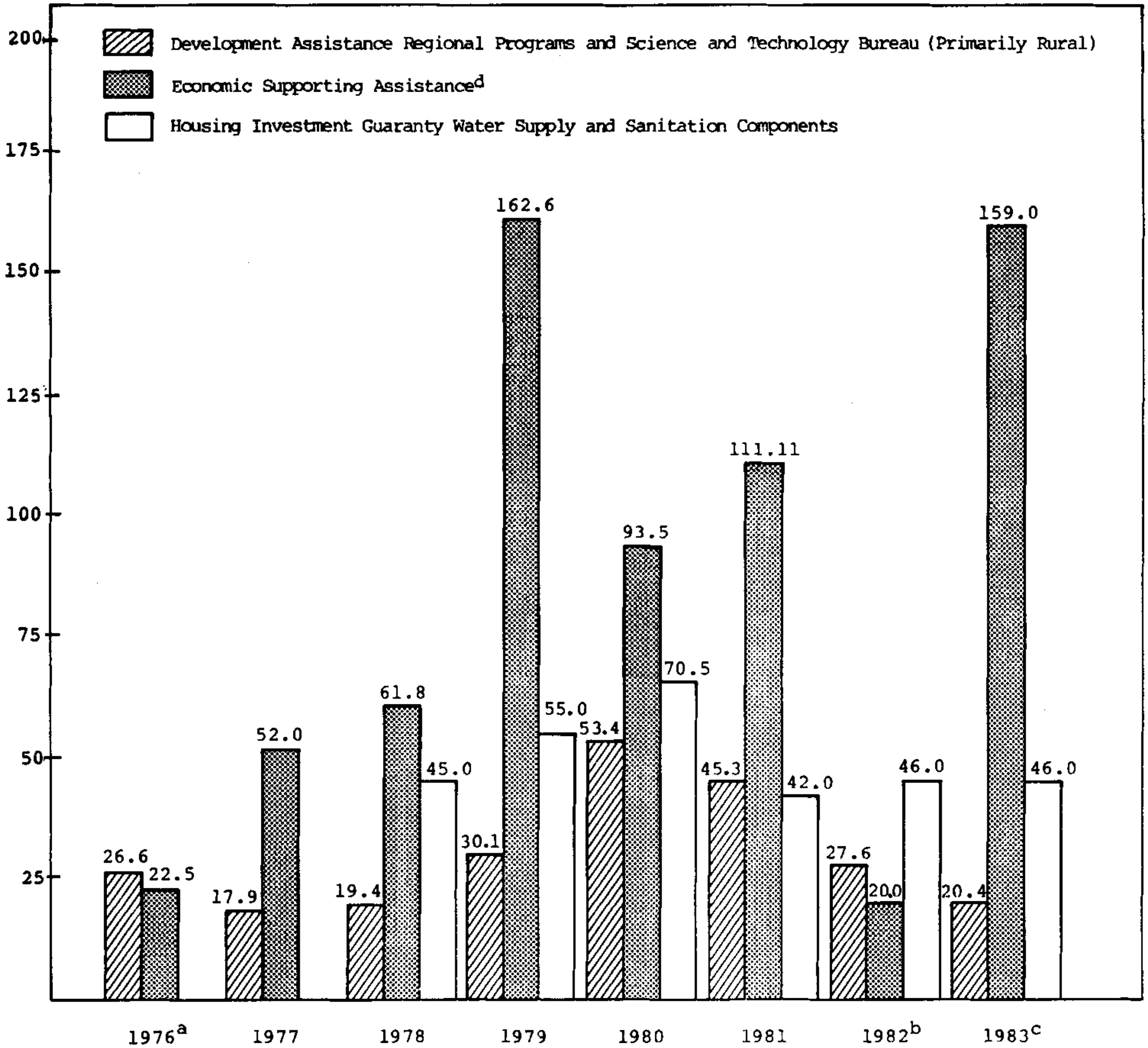
Table 3. AID Funding, Water Supply and Sanitation
Regional Development Assistance Programs (1978-1982*)
(in thousands of dollars)

	FY 1978	FY 1979	FY 1980	FY 1981	FY 1982	FY 1983[a]
Asia	$ 3,684	$ 3,500	$16,104	$ 9,400	$ 3,033	200
LAC	531	8,625	18,961	5,220	9,750	9,000
NE	5,978	7,584	3,813	5,650	2,200	----
Africa	6,757	10,357	11,864	19,889	10,171	8,826
Totals	$18,850	$30,066	$50,742	$40,159	$25,054	18,025

[a]1983 Requested

Source: Summaries of AID, Bureaus and WASH Project Activities and Requested Funding for Water Supply and Sanitation 1976-1983. Water Supply and Sanitation Division, Office of Health, April 9, 1982.

Figure 1. AID Water and Sanitation Funding by Category of Funding (1976 - 1983)



[a]Includes transitional quarter

[b]Planned

[c]Requested

[d]Nearly 80 percent of ESF funds allocated to Egypt

Source: Summaries of AID Bureaus and WASH Project Activities and Requested Funding for Water Supply and Sanitation, 1976-1983, Water Supply and Sanitation Division Office of Health, April 9, 1982.

for the 1981-1990 period in support of the United Nations Water Decade, but this multiyear budget was never approved and did not become AID policy.[5]

The reasons for overall declining support for water programs are not completely clear. Community water supplies are primarily funded from the Health, Population, and Nutrition budget which is declining as a portion of the entire AID budget. Water is not generally perceived as a cost-effective measure for improving health.

A recent article compared the costs of a number of health interventions to reduce infant and child mortality.[6] Water was cited as the least cost-effective method of averting deaths among infants and children when compared to a number of health measures. Each infant death averted through improved water supplies cost $3,600 compared to a cost of $200 for an infant death averted through selective primary health care.

The question of the effectiveness of water projects as a health intervention is clearly documented for the Asia Bureau. The Bureau has a policy against programming water projects for health improvement. The paper outlining this policy, A Health, Population and Nutrition Strategy for Asia (1980), states, "It is unlikely that AID and other donors will have the resources at any time soon that would permit construction of water supply systems that would bring about statistically significant improvements in infant and child mortality rates."

A supplementary reason may be a lack of relevant expertise in AID. There are few sanitary engineers remaining in AID and some of these are in administrative positions. A centrally funded project, Water and Sanitation for Health (WASH), has been designed to provide a pool of outside consultants to AID which may ultimately substitute for the lack of direct-hire expertise. The level of funding for water projects, however, has not yet responded to the availability of expert personnel through this contract.

B. Evaluation Activities

1. Background

The Office of Evaluation began work in the water sector with enthusiasm. The work plan written in preparation for the sector evaluation opened with the following paragraph:

> Rural water supply represents both an obligation and an opportunity for AID. The obligation has been imposed by the commitment of the United States to the Second Water Decade. The opportunity is to work in an area where the need is unquestioned, the money has been assured, and the technologies are well-known

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[5]Action memo signed by the Administrator, October 2, 1978.

[6]J. S. Walsh and K. S. Warren, "Selective Primary Health Care: An Interim Strategy for Disease Control in Developing Countries," The New England Journal of Medicine 301 (November 1979): 973.

and tested. In addition, improving the availability and the quality of water can improve the health and quality of life in rural areas as few other changes can. Under this set of circumstances, why then should AID not have on the shelf projects that would meet or exceed the willingness of the Congress to finance further interventions? In part, it is a realization that the previous interventions have not all been successful, they have been expensive to put in place, and the benefits have been diffuse and difficult to demonstrate.

The evaluation work in the water sector was viewed from its inception as an effort that should incorporate the combined experience and expertise of AID, other donors, and outside consultants. An interagency group was formed to coordinate the evaluation effort before the field studies (Figure 2). The first step was an examination of the issues in rural water supply by an international expert on community water supply.[7] This paper served as the basis for a workshop that included specialists from AID, other donor organizations, and the research and consulting community. The workshop consensus on what tended to make projects work or not work was distributed to all missions. The final activity prior to the field work was the analysis of previous AID activity in water projects.

2. Literature Review

In addition to the issues paper, the workshop, and the analysis of previous AID water activities carried out prior to the field work, data were examined from a health study carried out by the University of North Carolina. The results were published in an AID special study, Water Supply and Diarrhea: Guatemala Revisited.[8]

The results of evaluations by other international agencies of community water supply projects were examined. The Commission of the European Communities (OECD) did an ex-post evaluation of the status, utilization, and effectiveness of 29 community water supplies in six African states. This report, Basic Principles Emerging From the Ex-Post Evaluations of Investment Projects Financed by Community Aid in the Drinking Water Supply Sector, has 36 recommendations on water policy and general design, technical design and management of urban projects, and priority guidelines for rural projects and participation of the population. The evaluation was based on a survey of knowledgeable persons in West African and Sahelian states rather than on field work. The conclusions were drawn together in a workshop in Mali on November 1979. The evaluation also included conclusions based on existing literature. One of the conclusions based on a single-country study was that improved water quality and quantity have "scarcely any effect on the overall health situation" (emphasis in the original report).[9]

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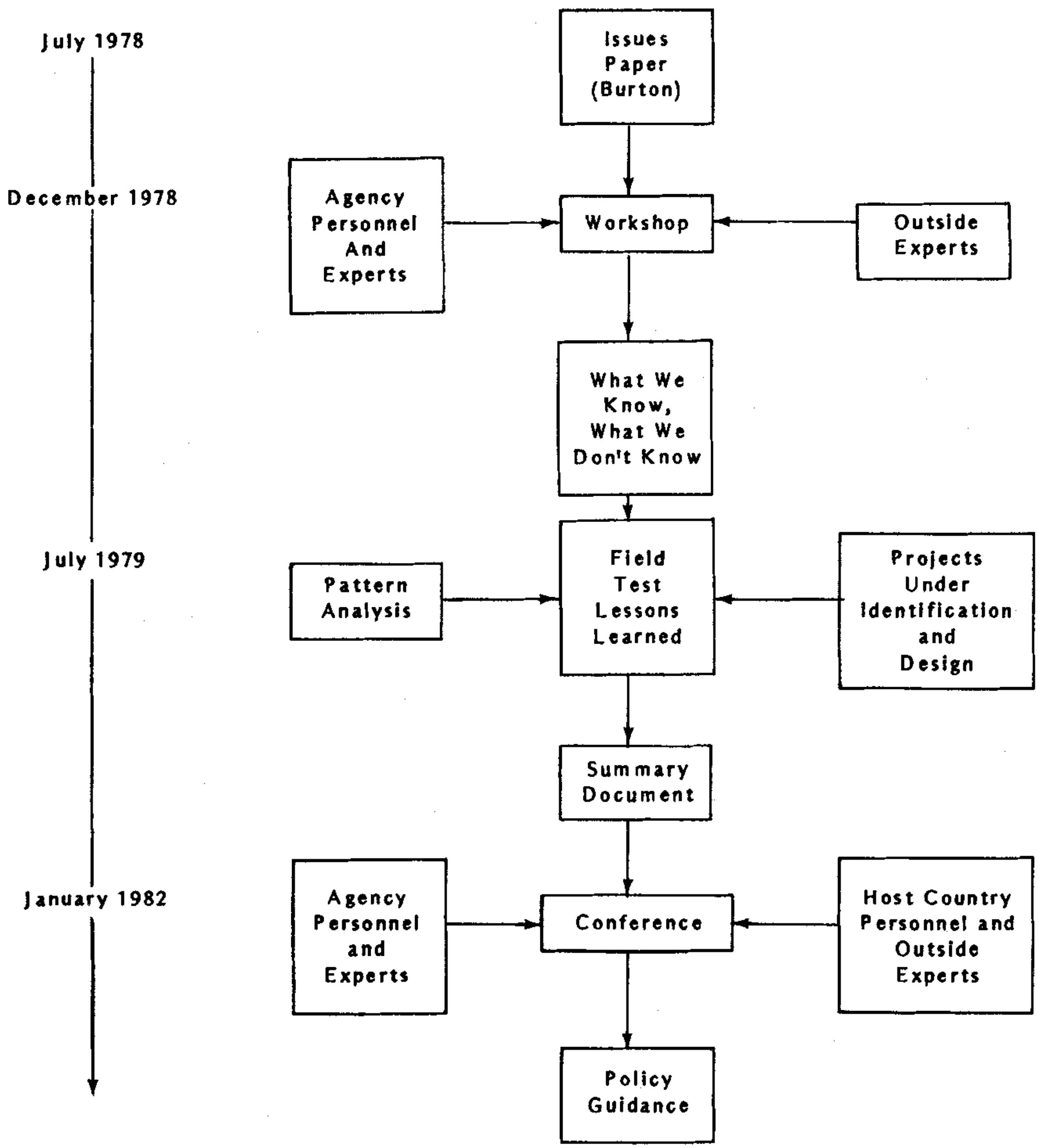
[7]Ian Burton, "Policy Directions for Rural Water Supply in Developing Countries," AID Program Evaluation Discussion Paper No. 4, Washington, April 1979.

[8]D. Dworkin and J. Dworkin, "Water Supply and Diarrhea: Guatemala Revisited," AID Evaluation Special Study No. 2, August 1980.

[9]Work cited was Feachan et al. Water, Health and Development: An Interdisciplinary Evaluation, London: Tri Med Books Ltd., 1978.

Figure 2. Evaluation Activities



The Comptroller General of the United States prepared a Report to Congress on U.S. Strategy Needed for Water Supply Assistance to Developing Countries.[10] The report had four objectives: "(1) to give an overall picture of the world's water resource development activities (especially in relation to the Water Decade), (2) identify problems associated with water resource development and constraints in meeting the U.N. Decade goal, (3) determine the U.S. strategy for providing assistance to develop water resources, and (4) offer our observations, conclusions, and recommendations on how the United States and others can more effectively provide their aid." The report is far ranging and includes much of the data gathered in Office of Evaluation field work.

3. Issues in Community Water Supply

From the issues paper and the workshop a number of working hypotheses were established on what makes projects successful and, conversely, what actions or lack of action make projects unsuccessful. The attributes of successful projects that we proposed to test were the following:

- Country Commitment. The host country must sustain the program over a long period and be willing to provide resources and to appoint qualified officials. There was no agreement on whether a successful program could be sustained without enthusiastic commitment or on how to generate commitment when it was lacking.

- Water Supply Goals and Plans. Effective programs require realistic national goals and plans based on actual conditions. The plans should have real commitments of money and will.

- Support Institutions. Institutions should be fiscally sound, and communities should eventually fully support the operation and maintenance costs. No single institutional model was considered appropriate, although health ministries were specifically singled out as weak. A single institution was considered necessary for construction and operation and maintenance.

- Donor Assistance. Donor assistance should be coordinated under a national plan and respond to all the needs of a country rather than concentrate on equipment and construction at the expense of preproject or postconstruction phases.

- Community Involvement. Communities should be aware of the costs and benefits of alternative levels of service and, within constraints, assist in the selection. A community organization should be formed to manage the system. Acceptable tariffs should be set. All persons involved in the project should communicate with the villagers.

- Technology. The technology should be maintainable by the institution and should provide an improvement over present sources of equipment supply. Local manufacture of equipment should be encouraged, and necessary materials procured locally.

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[10] Government Accounting Office report ID-81-51, August 25, 1981.

- Associated Impacts. Water systems would be more likely to succeed if they were a component in a program that included health education, sanitation, and education in the proper methods of collection and storage of water.

- Benefits. The benefits of improved water supplies were assumed to result partly from better quality water, but especially from increased availability. Health, time savings, and a better quality of life were all listed as possible benefits from improved water systems. Measurement of benefits was considered difficult and the workshop suggested interviewing villagers. The workshop report found that if people in a village considered that the water supply project had provided considerable benefits in health and other ways, then it probably has. "It would be worthwhile finding out more about how and under what circumstances village communities appreciate and perceive the benefits of improved water supply since such studies might provide guides to better planning for community involvement."

There were several issues on which there was little or no agreement. These included how to generate host-country commitment when it was lacking, how to sustain commitment when governments changed, and the best way to institute programs where there are no national goals or plans.

Some participants thought that training engineers and other technical personnel would ensure success, while others cited India's abundance of engineers and poor record in rural water projects. The workshop participants agreed that they did not know how to develop or provide excreta disposal systems that would be used.

There was no agreement on funding of the water system by the communities served. The workshop report stated:

> We suspect that it is important to provide a method of ensuring community contribution and involvement in the maintenance of the system. In some countries this might mean that money collected from the community resources to pay for system maintenance remain within the community. In early years, community contributions should be supplemented by an operation and maintenance fund set up as part of the original capital expenditure.

4. Field Studies

The purpose of the evaluation field work was to test the hypotheses advanced in the issues paper and workshop. Countries which had a diversity of approaches to water supply were sought. A goal was to include at least two countries in each of the AID regions. Three countries that provided an interesting mix of approaches--Tanzania, Kenya, and Thailand--were selected and visited. In each of these countries the evaluation included more than a single project.

In 1979 a new format for the evaluations was adopted under the direction of the recently appointed AID Administrator. Individual AID projects rather than countries were selected for study. Plans to examine the water programs in countries with diverse programs and approaches were dropped and individual AID projects were substituted.

Under the revised impact evaluation format, projects were evaluated in Tunisia, Korea, Peru, and Panama.

The early evaluations--Tanzania, Kenya and Thailand--all required six weeks of field work. The evaluations in Tunisia, Korea, Panama and Peru were carried out in four weeks.

Minimum time was spent in the country capital and maximum time in the field. Missions arranged for cooperation with the implementing agency where possible. In all cases a random sample of sites was visited. Samples were stratified by area and, in some cases, technology.

Each team prepared a questionnaire that included both direct and open-ended questions. The questionnaires ensured comparability between evaluations and focused on three broad sets of questions: (1) Were the systems working? (2) What were the uses and who were the users? (3) What were the benefits?

In Panama and Korea, more intensive studies on selected sites were conducted. The results of all the country studies were reported in the standard format of the AID Administrator's impact evaluation report which consists of a main section of 15 pages together with related appendices. The following countries and projects were examined:

Tanzania:	Shinyanga Shallow Well Project Morogoro Shallow Well Project Singida Windmill/Diesel Project Gravity Systems Diesel Systems
Kenya:	The Programs of the Ministry of Water Development CARE Water Project Harambee Projects Water Systems Developed by Private Organizations
Thailand:	Potable Water Project Shallow Well and Hand Pump Project
Tunisia:	Well and Spring Protection
Korea:	Market Town Water Systems
Panama:	National Rural Water Program
Peru:	Village Water Supply

Table 4 presents a summary of the projects.

C. Evaluation Findings and Impact Analysis

The evaluated water projects included some that were designed to provide water only and some that also had sanitation and health education components. Those projects providing water only were in Tanzania, Kenya, and one project in Thailand. Water supply

Table 4. Summary of Projects

Country	Implementing Agency	Time	Costs ($000)	No. of People Served	Project Elements
Kenya*	Ministry of Water Development and Donor Agencies	1970–1979	More than $70 million since 1970	No reliable estimate	Pumping, treatment and distribution systems Pumped or gravity-fed systems
Korea	Private Voluntary Organizations	1976–1979	$367 AID 1,422 Korea $1,789 Total	7,700	6 water systems which include pumping station, filtration elevated storage, and distribution Water committees to supervise each system Sanitation education program
Panama	Department of Environmental Health, MOH	1972–1976	$ 5,900 AID 14,000 Panama 400 UNICEF $20,300 Total	180,000 rural villagers	500 piped water systems using pumps, storage tanks 1,300 wells with hand pumps Train 20 rural sanitarians
Peru	Private Voluntary Organizations	1977–1981	$450 AID 193 Peru 189 CARE $832 Total	13,000 (at the 29 completed sites)	75 spring-fed gravity distribution systems with sedimentation tanks and filters 7 sewage systems Immunization and health education
Tanzania*	Government of Tanzania	1969–1981	More than $70 million by other donors	No reliable estimate	Water resource data collection Shallow wells with hand pumps (for potential AID project)
Thailand	Sanitary Engineering Division, MOPH	1966–1972	$2,900 AID 1,900 Thailand $4,800 Total	110,000 in small villages	250 treatment and distribution systems serving 600 Train 10 Thai engineers in United States In-service training for 150 people in MOPH
Tunisia	Private Voluntary Organization	1975–1979	$881 AID 771 Tunisia 174 Other $1,926 Total	100,000 rural poor	Renovate 300 existing wells and springs using hand and diesel pumps Institutionalize maintenance and disinfection Health education

*Country programs rather than single projects was combined with latrine development in Thailand and Panama and with both latrine and health education components in Tunisia, Peru, and Korea.

Water, latrines, and health education require different levels of community involvement. To be successful, a well-designed latrine program requires only that it be used. Health and hygiene education requires understanding and modification of present practices. Water systems require that the community use the water and support the system. Each component raises different issues and is covered separately.

1. Water Systems

Each evaluation examined three aspects of the water systems: reliability, benefits achieved, and access equity. The evaluations found a wide range of reliability, benefits,and access to water, ranging from completely reliable systems providing substantial benefits and serving all the community, to unreliable systems with few benefits and serving only a few elite members of a community.

The findings and analysis focused on the relationship of reliability to beneficial impacts of water systems. The evidence shows that they are both interrelated and affected by the technology selected. Evaluations discussed the adverse impacts of water systems as well as the distribution of benefits, equity of access, and the effect of water supply on women.

Reliability

The evaluation studies found the following systems to be the most reliable:

- The hand dug wells with locally manufactured hand pumps in Tanzania
- The gravity and pumped systems in Kenya built by local associations
- Diesel-pumped and gravity systems in Thailand
- Diesel-pumped wells in Tunisia
- Gravity systems in Peru
- Gravity systems in Panama
- Diesel-pumped systems in Korea

In Tanzania, hand-dug wells with hand pumps provided a reliable source of water at locations selected after consultation with the community. Construction labor was also provided by the community. In most cases reliability was assured by the installation of two or more wells to serve a single community. Hand pumps and all other manufactured items were produced at the regional office of the project from locally available materials. (The only exception was an imported valve assembly.)[11] Shallow well projects in two districts are the most reliable systems in Tanzania.

The water systems in Kenya, built and run by private associations that were completely independent of the national ministry, were among the most reliable systems in the country. These were often designed and built without adequate professional and

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[11]Shortages of materials in Tanzania have resulted in manufacture of pumps in Holland.

technical assistance. Although poor design often resulted in inadequate supply, members persisted in improving both the reliability and quantity of water furnished to users.

The Thai piped water project with 250 systems serving 600 communities had been a failure when it supplied water only through communal taps. By 1972, three years after the completion of the project, only one-quarter of the systems were working. In 1979, at the time of the evaluation, over 80 percent of these systems were operating and self-sufficient. The change resulted from the conversion from communal facilities to individual metered connections. The private connections provided more convenient sources of supply than had the water from existing community shallow wells.

The diesel-pumped systems in Tunisia provided a reliable supply of water from multiple taps fed by a storage tank. The pumped system was an improvement over the deep open wells where water was obtained by the use of a rope and bucket. Users developed their own fee schedules and assisted in collection of funds to provide for system operating costs.

The piped water systems in Peru and Panama were both built using self-help labor and both delivered water directly to the homes of users. A management committee was formed in each community which was responsible for raising money and repairing the system. In Peru all systems used gravity flow. In Panama, the gravity systems had few problems, whereas diesel-pumped systems were often unreliable because communities did not provide the funds for fuel.

A number of projects or certain aspects of the projects were unreliable. The unsuccessful projects shared one or more of the following features: they did little to improve access and were built mainly to improve the quality of water; they used technology that was not supportable; and, finally, the costs of operating the system exceeded the willingness or ability of the users to pay. The following systems were the least reliable:

- Diesel systems in Tanzania and Kenya
- Shallow wells with hand pumps in Thailand
- Deep wells with hand pumps in Thailand
- Piped communal water systems in Thailand (described above as a success after change to individual metered connections)
- Protected springs in Tunisia
- Shallow wells with hand pumps in Tunisia
- Diesel pumped systems in Panama

The unreliable systems that were built only to improve the quality of water were the shallow and deep well projects in Thailand, the piped water systems with communal water also in Thailand, and the protected springs and shallow wells with handpumps in Tunisia.

All had major reliability problems. The shallow wells were still providing water at the time of the evaluations, but with the use of a rope and bucket because well covers and hand pumps had been removed. In 1972, at the conclusion of the piped water project, only 25 percent of the systems were operating, and while the deep wells and hand pumps were usually operational they were seldom used. The sealed shallow wells with hand pumps, the chlorinated piped water, and the deep wells with hand pumps were all designed to improve the water quality in terms of bacteriological standards.

The water project in Tunisia was designed to improve the quality of the water and to teach people the proper use and benefits of potable water and latrines. Springs were protected by enclosing the water source, and access was limited to water flowing through a pipe imbedded in the concrete enclosure. Old Roman wells were cleaned, sealed, and hand pumps were installed. All wells were to be disinfected periodically. Users rushed to get water prior to disinfection and sometimes removed chlorine dispersing containers after they were inserted. Ropes and buckets were used to replace hand pumps that did not work. The users also breached many of the spring boxes, believing that the covers impeded the flow of water.

Systems that used an unsupportable technology were the diesel systems in Tanzania and Kenya. Getting spare parts was a major problem which was aggravated by the wide diversity of equipment, especially in Tanzania. Both countries had problems in delivering fuel to remote systems especially during rainy periods when roads were not passable. The problem was further complicated by a shortage of vehicles for delivery of fuel and for maintenance and repair services. Examples of systems that exceeded the willingness or ability of users to pay were found in Korea and Panama. In Korea, CARE built piped water systems in six market towns. Users were required to pay for individual private connections. Few people were served by the five functional systems that were completed. Most people liked the taste of their own shallow well water better than that from the piped systems and since most people had a private shallow well there was little incentive to pay for an additional source of water. The wealthy members of the community installed private connections and some, because of the unlimited supply of water, also installed flush toilets. In Panama some systems that used diesel fuel were not functioning because the costs of operating the system exceeded the communities' willingness to pay for the costs of operation.

Impacts and Benefits

The evidence for benefits was derived from statements of users, observation of users and uses, surveys, and macro-level health statistics. The evaluations did not claim that all the evidence would withstand rigorous scientific review. The evidence on reliability, however, is objective and accurate. The determination of users and uses is largely correct. The benefits data are basically subjective.

The water system users believed that they received substantial benefits from the systems. Communities in which planting and harvesting periods or alternate craft activities demanded substantial time allocations derived the most benefits from the systems. Cited benefits included improved health, increased convenience which improved the quality of life or provided time that could be used for activities that increased income, and productive uses of water in irrigating garden plots or raising animals.

The community's perception of benefits is relevant for gauging the impact of the system. In Kenya, where approximately half the systems were not reliable, the responses of those communities claiming benefits were correlated with the reliability of the system. Statistically significant differences in benefits existed between communities served with reliable and unreliable supplies. In communities reporting impact benefits, improved health was always cited. Of the communities that had reliable supplies, eight reported lower incidences of skin disease or less diarrhea, while two did not mention any change. Of the 12 communities served by unreliable supplies, only two reported any benefits.

In six of the seven countries, users reported substantial benefits. Four--Tanzania, Kenya, Panama and Peru--cited health or improved sanitation more often than other benefits. In Kenya, health was a poor third, while in Thailand health improvement was fourth on the list of benefits.

The benefits are related to the uses of the water systems. In both Thailand and Korea people used alternative sources of supply for drinking when available. Most water from the improved systems was used for irrigation and raising animals. The system water was also used for improved sanitary practices including bathing and washing.

A second group of benefits is related to increased convenience which saves time and can also result in increased water usage. Some villagers in every country visited, except Tunisia, cited convenience or time saving as a benefit. In most communities the team was able to document the fact that systems saved time, although it could not quantify the amount of time saved. The freed time was used for a variety of other activities. In Tanzania, Kenya, and Thailand the time was used for more agricultural activity. More craft activity resulted from the extra time in Peru, Thailand, and Kenya. Projects in Korea, Peru, and Panama provided more opportunity for leisure time. Koreans claimed time saving as the most important benefit of their systems. Those who had previously obtained water from community wells claimed that time saving was the major benefit (almost to the complete exclusion of other benefits), while those who had had a private well cited improved health and an easier life.

The reported impacts should be regarded with caution since they are not backed up by direct measures of health or economic activity. Reported impacts are, however, one indication of the value placed by people on an improved water supply. Clearly, the available data show a significant difference in perception of benefits between users served by a supply that is reliable and one that is not.

Reliability and Benefits

A reinforcing mechanism functions between system reliability and perceived benefits. This mechanism is the willingness of the communities to provide the necessary funds for system operations. The evaluations showed that, with a single exception, the systems that were reliable had an assured source of funding. Since national governments seldom provide sufficient funding, users are required to support the operation and maintenance of the systems.[12] The evaluations showed that users do not support systems where there are few benefits or where the costs are greater than the perceived benefits.

The relationship can be shown in a model of reliability leading to benefits which assure adequate funding (Figure 3). Evidence for the model can be found in systems evaluated in Kenya, Thailand, Peru, Panama, Korea, and Tunisia. In all these countries, systems which were perceived to provide substantial benefits were supported by the community. Support always included payment for operation and maintenance costs and sometimes included funds for expanding the system.

The most successful systems in Kenya were those that were built and supported by local associations. The systems were built either without any government support or

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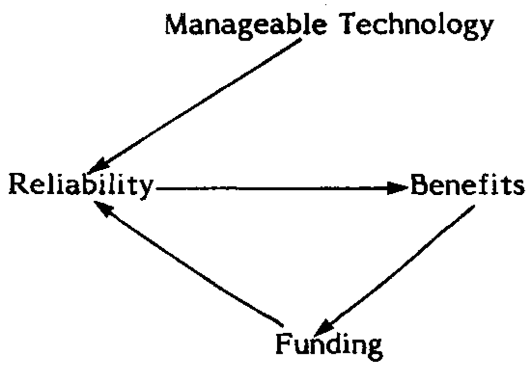
[12] The only exception was Korea.

under the formal Harambee or self-help rules. All were built with the substantial involvement of the community which had specific intended uses for water from the system, often for dairy cattle or other agricultural activities. Systems were operated independently of the Kenya Ministry of Water Development. Private entrepreneurs repaired and replaced faulty components and redesigned parts of the system that were inadequate. Funds for operating the systems were assessed directly to members. In one case, profits from a village cooperative were used to fund the operation of the system.

Figure 3. Water System Reliability Model



The strongest support for the model comes from the piped water systems in Thailand. Originally, the piped water systems in rural communities in Thailand were built with communal facilities. However, it was not possible to raise enough funds to operate the systems providing water to communal taps, so only 25 percent of the systems were operating well. When the systems were converted to private, metered connections, most of the systems were able to raise the funds for fuel, operators' salaries, and spare parts. Now over 80 percent of systems from 8 to 12 years old are operating successfully. These sophisticated systems with diesel pumps are operating reliably in villages where a previous project, shallow wells with hand pumps, had failed. The shallow wells were providing water but the pumps had long disappeared.

In Peru and Panama, water systems in most communities were operating successfully with adequate funds derived, for the most part, directly from users. Neither were supported by government budgets. Both systems piped water directly to the users and provided them with substantial benefits. In a few communities in Panama costs of operating the diesel-pumped systems exceeded the villagers willingness to pay. These systems operated only sporadically.

The only exceptions to the model were the reliable piped water systems in Korea, where at the time of the evaluations, there were two exceptions to the model: the piped water systems in Korea and the shallow well projects in Tanzania. The systems in Korea were partially supported while those in Tanzania had been wholly supported by the government. Both the piped water systems and the shallow well projects were reliable at the time of the evaluations. A recent change in Government of Tanzania policy that requires users to pay operating and maintenance costs has begun to affect the reliability of the shallow well projects.

In summary, governments seldom provided the necessary funding for operating the systems. Those systems that met the communities' needs also attracted the funds needed to operate and maintain the systems, sometimes from outside the agency designated to support the system. In the diesel-pumped well systems in Tunisia, the residents set up their own system for raising revenues when this was not envisioned in the project design. Systems that did not meet the needs of the community, such as the Tunisia protected springs, were not only not supported but were often destroyed.

The Relationship of Technology to Benefits and Reliability

The use of an appropriate technology is an important issue in determining the reliability of a system. One view of appropriate technology is based on its simplicity. This view holds that simple systems are appropriate and therefore reliable while complex systems are inappropriate and therefore unreliable. This is often the case. Complex systems are sometimes not manageable where they are installed.

On the other hand, simple systems without pumps or distribution systems may have little effect on improving the availability and convenience of water for the community. Such systems are seldom valued by the community and do not receive the necessary support.

The comparison of reliable systems and unreliable systems showed a predictable result in Tanzania; simple hand-pump systems generally worked and the more complex diesel systems did not. However, in two AID projects in Thailand, the situation was reversed. Simple hand pumps on shallow wells failed while most piped water systems powered by diesel engines and built to American Water Works Association standards were still functioning reliably 10 years after installation. The same Thai agency supported both systems and worked actively to develop an appropriate method for hand-pump maintenance. In Tunisia, as well, simple systems (protected springs and hand pumps) were less reliable than diesel-pumped systems. Users breeched more than half of the concrete enclosures protecting the springs from surface contamination and 40 percent of the hand pumps were out of repair. All of the wells with diesel pumps were working reliably.

The simple systems were often built to improve only the quality of the water available to a community. None of the systems that were designed simply to improve water quality alone were reliable, where quality is based on bacteria and mineral content measured by such criteria as those used in the WHO water standards. Water quality is a serious concern to most water users, but is often judged by standards of taste rather than by international health standards.

Some simple systems provided both better quality and more convenient water and thus were valued by the community; for example, the shallow wells and hand pumps program in Tanzania. Communities in which these pumps were installed had not been asked, at the time of the evaluation, to pay for the maintenance cost of the shallow wells. Villages may be willing to provide the necessary funds for pump maintainance and repair primarily because the arid environment in which they are installed provides few alternative supply sources.

In some cases, the high technology systems may exceed the ability of the institutions to provide the necessary support, regardless of how much the community values the system. Many diesel-pumped systems in Kenya and Tanzania were not reliable because of fuel shortages, lack of all-weather roads to deliver fuel, spare parts problems, and lack of trained personnel to repair systems. However, diesel engines, providing power for grain mills, were operating near communities where diesel engines to drive pumps did not function. In Panama, the diesel engines were unreliable because people did not provide enough funds for operating and maintaining the system.

Thus, the choice of an optimum technology poses a dilemma. By most measures, the best system is a piped water system delivering disinfected water directly to individual households. Of course, this system is the most expensive to build and usually the most expensive to operate. The villagers may not believe that the benefits of a sophisticated system are worth the costs and, as in some communities in Panama, may not provide the funding. Low-cost systems, however, that provide only an improvement in quality, also do not receive community support. The technology selected must provide an acceptable balance between improvements in convenience and a cost that users are willing to bear.

Equity Findings and Analysis

Equity is an important consideration in all AID assistance projects. The evaluations were therefore concerned with who had access to the improved systems. The degree of access varied; the extremes ranged from systems where the entire community was served to a system in Kenya that excluded all but a few of the community elite. Access is usually determined by the type of service selected. Systems with communal facilities provide access to all, while those with private connections serve only the users who control access to the water tap and who may or may not share the facility with others.

The systems in Tanzania, Peru, Panama, Tunisia, and selected systems in Kenya and Thailand all provided access to virtually the entire community. These systems, with the exception of those in Tunisia, were planned with the communities and all were self-help systems. The evaluations show that universal access is more likely to occur when there is substantial community involvement in planning and implementing the system.

Access was usually linked to the requirement for raising funds. The most extreme case of a attempt to link system funding and access occurred in Kenya. The Water Development Ministry (MWD) systems were built with a mix of communal facilities and private connections. To encourage the users of communal facilities to obtain and pay for individual connections, the MWD located the communal facilities inconveniently, restricted the hours of service, closed some completely and failed to repair those that were not functioning. The result was that some large systems built to serve an extensive population served only a few community elite. The action, however, did not always raise the expected funds. There was a shortage of meters and the system users with private connections frequently paid only a minimal flat rate fee for the unlimited supply of water. Also while the actions of the MWD may have encouraged users to pay for private connections, they often could not get them. The government had subsidized installation and the budgeted funds were often insufficient to provide service for everyone requesting it.

Another less stringent method of controlling access to a communal facility is a kiosk system. The evaluation team reviewed two kiosks in Kenya. The kiosk operator controlled a communal facility, purchased water from the MWD, and dispensed it by the container at a price that provided the operator with a profit. The kiosks visited served only a few users, and most of them shifted to traditional water sources during periods when they were available.

The systems in Korea were all metered private connections and generally served only the community elite, although CARE had planned the project to serve more than half the community. In three of the five operating systems, less than half of the residents were connected. The reason given for not paying for an individual connection was the cost for connections to the system.

In general, the reasons for restricting access were economic. In Kenya, the end effect was irrational and meant that the capital cost per individual private connection was exorbitant. In one system in Peru, a community leader preempted all the pipe to serve his own house, and villagers who wanted service had to pay him for pipe.

Women

Women have virtually the sole responsibility for water bearing in the developing world, although this role is sometimes shared with their children. They are the persons most affected by water projects, especially those projects that make water more convenient. Women were found invariably to be enthusiastic supporters of the improved water systems. Women in Tanzania, Thailand, Peru, Panama, and Kenya stated that the water systems made their lives easier and that they could now substitute productive employment for menial, nonproductive labor.

Some women experienced their first involvement with political activity in the community as part of water management committees. In Kenya, women in one community were completely responsible for organizing the efforts that led to the building of the water system. In other communities, they participated with men or management committees of Harambee projects. There are few types of development projects in which the benefits flow so directly to women.

Waste-water

Evaluation teams noticed several instances of failure to deal with waste-water. In Korea, the increased water supply encouraged the installation of flush toilets. Toilet waste water was collected in septic tanks with limited capacity. Overflow from the septic tanks was piped to open drainage ditches with potential serious health consequences for downstream users. In several locations in Kenya, Tanzania, and Peru little consideration was given to excess water at community taps. The amount of accumulated water varied from location to location and the potential health hazard was not ascertained.

2. Latrine Systems

Three evaluated projects had latrine or sewer components: projects in Panama, Tunisia, and Peru. The Panama latrine project that funded 13,000 latrines in 1976 was dropped in 1979 after only 900 were built. The reason cited was inability to confirm that design specifications were being met. The problem was not related to the quality of the latrines, but simply the inability of USAID to monitor the large number of installations. The Tunisian project funded construction of latrines in demonstration communities. The latrines were not used by villagers for the purpose intended, but served as storage facilities, chicken coops, or were reserved for the use of city relatives visiting the village. The Peru project for excreta disposal was a self-help project to install piped sewers. While it was easy to muster wide community support for water systems, the project had difficulty mobilizing the required labor for installing sewer lines. Even when they were installed, few people would connect to them. In the one community with a completed sewer system that was visited by the evaluation team, only one-sixth of the families with potential access to the sewer line had connected to it.

The latrine programs were not working in the evaluated projects although latrines were widely used in some countries. In Tanzania, most families in the villages already had and used latrines. Korean families were also all served by latrines. In Thailand, a previous AID project had funded the introduction and construction of water-sealed privies and these were adopted almost universally without further funding in villages with piped water systems. An average of 80 percent of the families in communities with piped water systems have water-sealed privies. This can be compared to a sample of villages without piped water in the same area where less than half the families have either simple pit privies or water-sealed latrines.

The issue with latrines is not whether to build them but whether latrines can be an effective intervention as a component of a water project. Experience indicates that they have not been effective. While latrines may be important in a number of environments, they need a careful analysis of the cultural practices of the community to determine what may be perceived not only as beneficial, but also acceptable.

3. Health Education

Health education was a component of the water projects in Tunisia, Peru, and Korea. In each of the countries there were problems in implementation and the entire program had no discernible impact. The most ambitious project was Tunisia's which funded vehicles and salaries for the effort. The program was abandoned in one area and was faltering in all others. It had a low priority with the Ministry of Health, and site visits by health education teams were infrequent and irregular and the information delivered was uninspired and repetitive.

The health education efforts in Peru and Korea have had somewhat parallel experiences. The number of education sessions were all less than had been planned, and they had no discernible impact. In Korea, where gifts were distributed for attendance, few villagers came to the session. In Peru, attendance and interest were high, but few sessions were held and few villages covered.

Although health and hygiene education is an important factor in the prevention of disease, water projects do not seem to be a suitable vehicle for their implementation. In a review of the literature on education to effect change, White and White note that one important factor is

> the degree to which the new knowledge is consistent with the present attitudes of the people involved and is perceived by them as useful to the attainment of a wide spectrum of other valued

goals, such as better housing, health, employment, status in the community, etc.[13]

The health education components in the three projects evaluated were all poorly executed. They were treated as "add ons" to a water project and were implemented only to meet the requirements of the project paper or program grant.

Successful models of health and hygiene education do exist. The school system in Korea has an active program from the earliest grades. A long-term integration of health education with the school curriculum may be required to obtain the desired behavioral changes.

D. Conditions Making Success More Likely

Many water projects were successful. The evaluations show that all the AID projects had some successful elements. In this section, findings from the evaluations are reviewed to identify elements that tend to make projects succeed or fail. In addition to the data from the evaluations, the conference participants were invited to present other evidence to support, change, or refute the findings of the evaluations.

Field evidence, rather than the literature, was stressed. The evaluations showed that there is a wide divergence between actual field conditions and and some of the conjectures in the literature. For example, the Thai piped water systems were widely believed to be a complete failure, a case of U.S. technology gone astray. Actually, they provided a model that was extended within the communities and replicated widely in other areas in Thailand.

This section first addresses the concerns of the community. The evaluation evidence shows that a basic mistake is made when projects are designed for the agendas of donors rather than the communities they will serve. The section then addresses technology, system benefits, latrines and health education, support and funding of projects, dealing with institutions, the commitment of host country governments, country goals and plans, and finally, the role of AID.

1. Community Concerns

The evidence shows that when communities value a system, the system tends to be successful. Systems that were built to fulfill AID's perceived need to provide only better quality water were not valued and did not survive. The best way to ensure that the community will value the system is to involve the users in the decision on whether to build a system.

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[13] Anne U. White and Gilbert F. White, "Reappraisal and Response to Changing Service Levels, "Project Monitoring and Reappraisal in the Internatinal Drinking Water Supply and Sanitation Decade, American Society of Civil Engineers, New York, May 1981.

There are several reasons for involving members of the community in the project decision-making process and for addressing their needs directly. Every community has some source of water and the improved system must be viewed as better than the old system for some or all of the intended purposes. The role of traditional community patterns of water use may not be fully appreciated unless there is some basic interaction between planners and the community. The standards used by many communities are seldom addressed. These can include such diverse factors as the quality of the tea produced by the water, or, as in Thailand, an almost universal preference for the taste of rain water or shallow well water for drinking.

Community involvement does not have to be a complex undertaking. At the most basic level, the community must know what the system will provide and what will be their responsibility. In other settings, a more involved effort to set up water management committees or self-help efforts might be considered appropriate.

Payments for Water Systems

Systems that require users to pay the full cost of operating and maintaining them tend to be more successful than those that do not. Only one reliable project, Tanzania, required no payment for operating and maintaining the system; one other system, Korea, was reliable and required only partial payment. Moreover, no systems where users paid the full costs of operation and maintenance were unreliable. Most systems require funds for operation and maintenance, and with the exception of Korea, no government provided sufficient operational funding. Those systems that raise sufficient community funds can use private sector resources to repair and replace components of the systems that fail. Kenya and Thailand are examples of this practice.

Community Development

AID sanitary engineers commonly speak of "perceived development." They say that when you walk into a community, you can tell if an improved water system exists simply by the nature of the community. The evaluations in Kenya, Tanzania, Peru, and Panama may have captured this same concept in the claim that water systems gave the community a sense of being progressive or developed. Even the seldom-used latrines that were saved for the use of urban visitors may have served the function of expressing to others a demonstration of progress. Agua del Pueblo, in its successful program of building water systems in Guatemala, claims that the perceptions of development is a major benefit of a self-supported water system.

Community Management of the Systems

Systems that are managed by communities tend to be more reliable than those without local management. Most reliable systems, with the exception of some in the communities in Korea, were locally managed; however, not all systems with local management were reliable. Local management is most important in small rural communities. Local management did contribute to system success by setting policies that accommodated local concerns, ensured the collection of funds, provided for repair or reporting of problems, and ensured that the systems accommodated changing conditions, such as population growth or a rise in the price of fuel. More than others, the project design in Korea emphasized the need for a management committee. However, committees were not needed since the systems served market towns of 15,000 people and had an effective county government which ran the systems efficiently.

Equity

The community elite usually value an improved source of water and often can dominate the system for their own use and benefit. The systems that were built without extensive community involvement in Thailand, Kenya, and Korea were used by just a few of the community elite. In towns in Thailand, for example, merchants in sanitary districts (market towns) often used funds raised by community taxes to make the contribution required as a precondition for approval to receive a system. In those towns, the system often served only the merchants. The other extreme was found in a Thai community where the water system was managed by a local monk. He insisted that all residents or none be served by individual metered connections.

Equity can be assured even for systems which use private connections. It is traditional to require users to pay the costs of hooking into the distribution line. This could be altered by funding the costs of private service as part of the project and recovering the costs through a combination of water rates and upfront contributions. Even if the private connections were metered, the poor would be assured of a basic supply of water by an increasing block rate pricing structure. With this pricing structure, an amount of water sufficient to meet the minimum basic needs of a household is sold at a low price while each subsequent unit of water (block) is sold at an increasing cost.

2. Technology

While the ideal water supply may be a constant supply of disinfected water to individual houses, this cannot be achieved in all rural areas of the developing world. The field evaluations identified four limiting factors on technology: costs, both of building and operating the system; the ability of the country's infrastructure to support the system; the ability of the institution to design and build the systems; and the willingness of the country to sanction the imports needed to maintain the system.

Limiting Factors

A serious consideration in addressing the problem of rural water supply is cost, both the capital cost of building the system and the cost of operating and maintaining them. A high capital cost per unit means a low potential for replicability without donor support. AID funding would serve few people and the unit cost may exceed the actual benefits derived from the system.

Far more important, however, are the costs of operating and maintaining the system. The full costs of operation and maintenance should be borne by the communities, including the costs of delivering the service by the institution charged with support of the system. However the costs are divided, they must be paid. Some diesel systems in Panama are in trouble because of the high cost of diesel fuel. The high cost of water at a kiosk in Kenya means that people use traditional sources whenever available. Presumably, users in Panama and Kenya make judgments based on the benefits of the system and are willing to pay no more than these benefits, less the costs of an alternative supply.

While these calculations are not formalized, they provide the elements of a decision process that is also applicable to AID. AID would presumably not be willing to make an investment that would, over a period of years, provide fewer benefits than the cost of the system would warrant. The first limitation on the choice of technology, then, is that a system must provide to the user, individually and collectively, more benefits than the system costs to build, operate, and maintain.

The second consideration that limits technology is the ability of the country's infrastructure to support the system. Diesel water systems need periodic resupply of fuel, while other systems may need pipes, spare parts, and skilled persons to install them.

Third, the technology used on systems is limited by the ability of the staff of the implementing agency to design and build systems. While these skills can be provided by consultants, ultimately the responsible agency will need in-house people or the system will not be replicated and spread to other parts of the country.

The fourth limitation on technology is the unwillingness or the inability of governments to allow imports of the elements needed to keep the systems operational. This was a major factor in determining the condition of systems in Tanzania.

Community Concerns About Technology

While there are a number of factors that set upper limits on the sophistication of the technology, serious limits are also set on the lower level by the desires of the communities and AID. There seems to be a Gresham's Law of Water Systems. Each improved system must represent an increase in convenience and reliability or it will be driven out by traditional sources of equal reliability and convenience. No system will be successful unless it is an improvement over existing conditions and is perceived to be so by the community. The field evidence for this statement is overwhelming.

On the other hand, AID may be unwilling to fund projects at a certain level of technology, even if the system represents an improvement over current sources. Open shallow wells are an effective technology, well-grounded in American tradition, that could represent an important improvement over the traditional sources of supply which are available in countries or regions with no institutional support. Few shallow well projects are funded by AID because they are not viewed as an appropriate standard for water projects.

3. Benefits and Impact

Community water system projects that generate benefits must provide a reliable supply of water, improve the quality and convenience, and be used by a large segment of the community. Benefits come from any of the three attributes of water systems as discussed previously: convenience, increased water quantity, and increased water quality (Figure 4). The systems that provide major benefits ranged from simple, communal facilities to systems which piped water directly to the home. The projects that failed to provide benefits also included the total range of technologies.

The measurement of benefits, particularly health benefits, is a component of the many of the projects funded by AID. However, benefits of the evaluated systems were not quantified or ranked. Those systems that provided water as direct inputs to agricultural or nonagricultural processes or that saved substantial amounts of time were perceived by users to provide the most obvious benefits. Although health benefits were perceived by the communities to result from the water projects, the evaluation teams could not demonstrate these health benefits unequivocally. A selection of studies from the existing literature could support either acceptance or rejection of the hypothesis that better water supplies improve health.

4. Institutions

The Thai shallow wells that were built 20 years ago continued to provide water long after the hand pumps had disappeared and will continue to serve users for many years without any supporting institution. There are a few other low-technology options such as shallow wells, impoundments, and rain catchments that, once built, can provide long periods of trouble-free service.

Other projects require an organization to build and service the systems. The systems that succeeded had or later developed effective institutions that could design, build and supervise operation and repair of systems after they were built. Some institutions succeeded on all counts. Others had problems only with maintenance. The Thai Sanitary Engineering Division of the Ministry of Health both built and maintained systems well. Panama also was effective in building and maintaining systems. The newer systems, in Panama however, are more complex and design problems are affecting their function.[14]

The Kenya Ministry of Water Development had problems with both building and maintaining systems. Programs scheduled for two years often required six years for completion. Needlessly complex bureaucratic procedures strongly affected the implementation process so that even if there were no other problems within the Ministry, it would be difficult to plan an effective program. Other related problems do exist and require resolution before Kenya can develop an effective community water supply program.

The institutions all required trained personnel, and systems should be funded according to the ability of the engineers of the institution to design and supervise the project. Systems in five countries had some design problems that were particularly acute for the private voluntary organizations (PVO) that implemented many projects.

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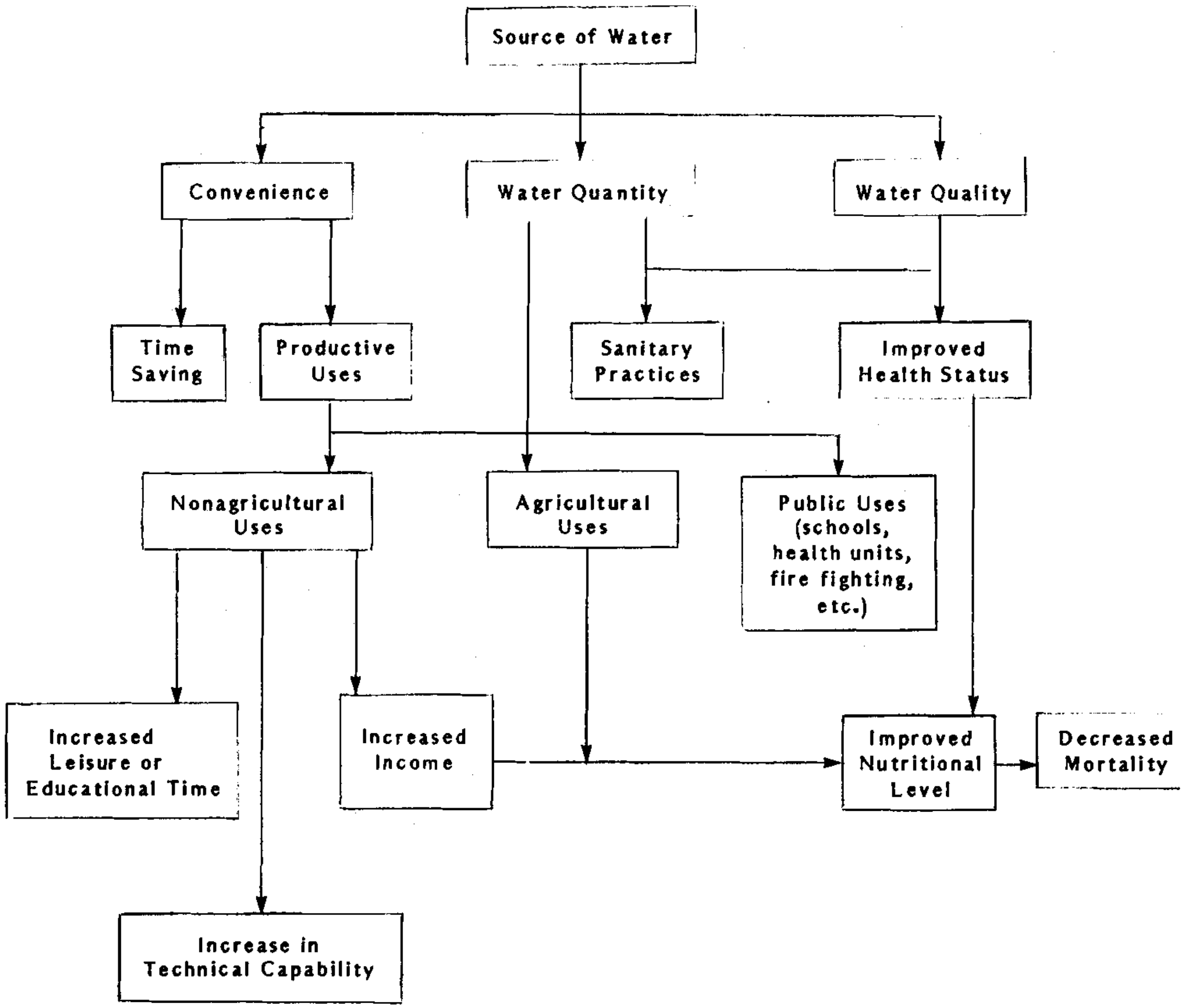
[14]In Kenya, and to a lesser extent in Thailand, private entrepreneurs were an effective alternative to the government institutions. Communities with sufficient funds contracted with local technicians and mechanics for both building and repair of systems.

Figure 4. Water Supply Benefits Model



An institutional problem affecting the systems in Peru was the division of responsibility for building and maintaining the systems. The Ministry of Health was unwilling to accept supervisory responsibility for the systems built by another Ministry that had orginally been set up to coordinate earthquake relief; this institutional difficulty may affect the long-term reliability of the systems.

5. Country Commitment

A strong country commitment was considered by the earlier workshop to be important for the success of water supply programs. However, the field work demonstrated that most of the indicators of commitment were not present in countries with successful programs. No country except Korea provided adequate funding levels or was committed to building and maintaining systems. On the other hand, all countries with the exception of Tunisia had a strong, stated policy on the importance of rural water supply projects.

6. Health Education and Latrine Programs

The evidence of the field evaluations supports the conclusion that neither health education nor latrines should automatically be funded as part of a water project.

7. The Role of AID

The major objective of the evaluation work was to provide an analytic and experiential component from which to develop policy and program decisions on community water projects. The results can be used in at least three ways: as an input to policy, as an aspect of the decision to fund projects, and in the design of projects which will tend to be reliable and provide benefits equitably to rural communities. The decision to fund projects and the design implications are reviewed below.

The Decision To Fund Water Projects

Water projects can be important to overall development goals by increasing agricultural production, improving health, providing extra time for economic activities, and improving community self-reliance.

Villagers in Thailand, Peru, Panama, and Tunisia used water or waste water runoff for irrigation and raising animals for market. These irrigation and animal-rearing activities had substantial impact in some communities. The evaluations did not place a value on the output of products, but in some villages they were clearly significant. Villages in Thailand claimed that the value of increased crops was enough to allow male heads of families to stay home rather than migrate to Bangkok as casual workers during periods of drought.

The most common indirect impact claimed was improved health through reduction in diarrhea and skin disease. The health improvement was not verifiable, but a number of activities that are usually associated with good health practices did occur. The Thai villages with piped water systems built and used water-sealed privies. In

Thailand, Panama, and Korea indoor or outdoor bathing and shower facilities were provided. A tabulation of reported health benefits according to reliability of systems indicated that villages with reliable systems reported health benefits much more frequently than those that obtained water from unreliable systems. The preponderance of evidence is that increased quantity and better quality water have health impacts, but that the degree of the health improvement is not known.

Another development impact was time saved by easier access to water, time that could be applied to increased crop production. A farmer in Kenya reported that the released time freed women to provide important assistance during peak labor periods. Tanzanians reported smaller crop losses. A number of village members claimed that they could now produce more craft items. None of these women-oriented activities were quantified nor were vigorous investigations undertaken to determine the economic value of the increased production.

The final impact of the projects was to increase the perceived effectiveness of the communities' own direct role in their development. This was expressed in a number of ways and was clearly related to both the reliability of the project and the community involvement. Tanzanian communities that provided labor, Thais who donated money, and Peruvians who contributed both were proud of their ability to affect their own destiny.

What To Fund

AID funds that can be devoted to water projects are limited and should be used in countries where there is a reasonable chance for success. Because the long-term reliability of water projects is often affected by the actions of the host-country government, certain issues need to be addressed in planning a project. The host country should provide adequate funding for an institution that will handle functions beyond the operation and maintenance costs borne by the communities. It should also provide the responsible national agency with clear bureaucratic authority to build and maintain systems. Foreign exchange should be made available for the import of necessary materials and equipment to maintain and operate the systems. Problems with any of these areas will jeopardize the long-term impact of any water project.

Project Design and Community Support

Water supplies have three separate attributes, each with a different impact on development: quality, quantity, and convenience. The water quality is an important factor in the impact of the supply on health; the quantity of water determines the amount available for specific uses; and the convenience determines the saving in time and the amount of water that will be used.

AID and other donors have had trouble setting policy on the quality of water to be supplied. Partly because of its view of water as a health intervention, AID has built projects to ensure high standards of water quality, a value not shared by its users. In Tunisia, users were hostile to such a project and destroyed the concrete spring boxes and the chlorination containers placed in wells. Projects that provided only improvements in water quality were not maintained.

The goal of AID projects should be to improve the convenience of available water, while improving or maintaining water quality. To do this, AID should consider a full range of activities, including open shallow wells with curbs to prevent surface water intrusion. This is a useful option in communities where other more advanced options could not be maintained. The open dug well is on one extreme of a technological continuum whose opposite is piped chlorinated water delivered to the home in large quantities. The community should be aware of the options of the continuum and the financial implications of each.

AID policy requires that projects be socially sound. The criteria for social soundness include project compatibility with the cultural practices of the community, involvement of the members of the community, and assurance of equitable access and a beneficial impact. AID is also concerned that the benefits are sustainable and capable of replication and expansion without further AID funding.

Cultural compatibility can be assured by community participation, which participation which can also result in support of the project by the political and economic elite in the community as well as the majority of householders. If the planned project is not acceptable to the elite, it will not be supported and, even if built, it may not be maintained. However, projects that are planned only with the elite members of the community may be dominated by them. In Thailand, villages were required to contribute funds as a prerequisite for building a system. Systems in market towns that were supported only by the village merchants or by the political heads of the town who contributed money to the town treasury, generally served only the merchants. In communities where there was widespread fund raising, the majority of the population was served even when a disproportionate share of the contributions were raised from the wealthier members of the community.

Participation by the majority of the community will tend to assure equitable access for systems with only communal facilities. Systems that provide water exclusively from private connections required a capital contribution from community members in Kenya, Thailand, and Korea. As a result, several systems served only a few wealthy members of the community and raised little revenue. It would be equitable and more productive to fund the cost of metered private connections as part of the initial capital cost of the system. Revenues then could be set with the concurrence of the community to provide basic service at a low rate. Increased amounts of water would be delivered at higher unit rates. This block rate would assure that everyone received an amount of water necessary to cover basic needs at a low fee. Water used as an amenity or for productive uses would then be provided at higher fees.

Problems with the equitable access and distribution of benefits arise in systems with both communal facilities and private service. The individual connection provides, by its very nature, a disparate access to benefits. To assure equity, private connections should be available to all within the service area. Charges for such a connection should not be subsidized, as in Kenya, but should be built at full cost. Tariffs for water use by private users should be set to repay the appropriate portion of the capital costs of the water treatment and distribution facilities devoted to providing the required level of service.

A project that was not evaluated, the Barangay project in the Philippines, had a mix of private and public facilities and claimed that there were few problems in establishing rates and collecting charges from both private and communal users. This project may provide important lessons from the point of view of public participation in planning, locating communal facilities, and rate setting to assure sufficient revenues for system operation, maintenance, and capital payback.

Project Acceptability

While community acceptability has already been discussed, other significant problems of acceptability are posed by AID, host-country officials and engineers, and others serving as consultants to AID or to the host country. Water project plans should be reviewed by the appropriate agencies and may include:

- Regional and national-level implementing agency personnel
- Policy and budget officials at the national level
- AID regional bureaus, the Bureau for Program and Policy Coordination, and S and T personnel
- WASH and other contractors

It is important that the affected groups support or at least accept any proposed plan. Opposition may require that the project be modified or abandoned. The planner must always be aware of the difficulty of reconciling differences and the value of plan review.

Institutional Support

A critical element in project design is assessing the capability of different institutions to support projects. In some countries, no choice exists; in others, several agencies could supply project support. In Tunisia and Korea, the choices of implementing agencies was not appropriate.

The AID project planner must assess whether the proposed institution shares its view of the problem and the possible solutions. Some implementing agencies may not regard low-level systems as acceptable even though they have been unable to financially support higher levels of technology, a situation that arose in Kenya.

In addition, some institutions are unresponsive to any form of innovative projects. Institutions that are responsive to the proposed project approach must be supplied with the resources necessary to carry out the project. This includes vehicles, equipment, and training at all levels. Assessing the institutional capability and needs and providing for those needs are important aspects of project design.

Alternatives to Conventional Institutional Support

A substantial portion of the water supply support in the United States is provided by the private sector. This is also true in some developing countries. Both Thai and Kenyan water systems had private sector alternatives to technical support by the water agencies. AID should consider such alternative methods of building, maintaining and operating, systems. This would provide a backstop for system reliability where institutions are inefficient or unable to provide the needed services. Where communities have the funds and value the systems, they sometimes elect to use private contractors to provide system repair, maintenance, or expansion.

E. Policy Implications

The following policy implications are derived from the evaluations, the synthesis of the water supply sector field experience, the overall three-year evaluation process, and the Conference Work Group report.

1. Expanding the Resource Base

AID recognizes the multiple benefits of water supply and sanitation projects and allows the funding of projects from the Food and Nutrition Account (FAA, Section 103) as well as the Health Development Assistance Account (Section 104).

2. Basic Design Objective

Community water supply projects should be designed to provide a reliable and convenient source of water. The quality of water should be addressed within the environmental and social setting with careful consideration of costs and the potential for general replication.

3. Community Financial Support

In preparing community water supply projects, communities should be contacted early in the process to determine the commitment to and value placed on water supply systems. Local users should support the costs of operations and maintenance of community water supplies. In the case of simpler systems, such as wells or hand pumps, they should also contribute cash, materials or labor to construction costs. Water projects should be designed to be self-supporting, with some measure of capital recovery if feasible, preferably through direct payment by the beneficiaries or through some form of cross-subsidy. Funds collected for operation and maintenance should remain with the local water organization when feasible.

4. Institutional Support

Water supply projects should provide for strong financial and technical institutions or authorities to oversee construction and establishment of local water systems and which serve as a source of assistance to communities and users associations once they become responsible for on-going operations and maintenance. Wherever possible, existing national, regional, or local institutions should be used; where necessary, new ones should be created.

5. Training

Construction, maintenance and operations training needs should be directly addressed in the project design or be provided for, as necessary, in a specially designed complementary training project. In addition to the traditional concern of training engineers, emphasis should be given to the training of training specialists, administrative staff, managerial staff, and skilled operations and maintenance labor.

6. Sanitation Components

Water supply is generally a higher priority than sanitation for rural communities in developing countries. Inclusion of latrine and excreta disposal, solid waste disposal, wastewater disposal, and drainage components with water supply projects should depend on the density of the population being served, physical characteristics of the project zone, and per capita water use.

7. Ancillary Components

The inclusion of ancillary components in a water supply project should be decided on the basis of the needs assessment, the feasibility studies, and an indication of community interest and prospects for long-term support. Such ancillary components include, but are not restricted to, health education, sanitation, training, institutional develoment, and income-generating activities.

8. User Education

A user education component may be appropriate for some community water projects, to consist of instructions on use of pump mechanisms and valves, water conservation and notification of proper authorities for system malfunctions. In certain settings (open wells, health hazards from standing water) some health education may be helpful. In these situations, existing education institutions or other alternatives should be considered before undertaking the development of special health education components.

III. Conclusions on the Hypotheses Tested

Of the hypotheses developed in the 1979 workshop at the beginning of the AID Office of Evaluation work in the water sector, a number of the hypotheses still hold after a review of the evidence from the impact evaluation field work. The evaluations confirmed that projects are most likely to succeed when:

- Tariff structures and payment schedules result from discussions and are acceptable to the community
- A local users group is formulated to set management policies and determine local priorities
- The water supply organization is able to support and maintain the equipment used
- The technology chosen represents an incremental improvement over the existing level and can offer the prospect of further step-by-step progress
- Diversity of equipment, which makes for problems in procurement and supply of parts, is limited
- Internal and external funding is assured and programs are planned within the budget limits
- The agency can attract and hold qualified personnel

Projects are less likely to succeed when:

- Different agencies and institutions are responsible for operation and maintenance.

The following additional conditions not found in the Workshop report are also important to the success of water systems:

- Technologies used for projects should not exceed the logistic and technical support capability of the institution
- Private sector sources of equipment, supplies, and expertise to service communities are required when institutional support is inadequate

We have confirmed the following conditions on which there was initial disagreement at the Workshop. These factors were also important aspects of the success of projects:

- It is important to provide a method of ensuring community contribution and involvement in the maintenance of the system. In some countries, this might mean that money collected from the community to pay for system maintenance would remain within the community. In early years, community contributions could be supplemented by an operation and maintenance fund set up as part of the original capital expenditure.

The results of the field evaluations also support the findings concerning benefits which were developed by the earlier Workshop. The Workshop report on benefits is reproduced below:

> It is generally agreed that major benefits are to be gained from improved rural water supply, but it is extremely difficult to measure or quantify such benefits. The aim of AID projects should be to provide increased quantities of water to the people in rural areas.
>
> The following benefits are assumed to result from such an action:
>
> - Improved health by protection from infection from ingestion of unsafe water.
> - Improved health from increased availability of water for more frequent washing of persons, clothing, and household effects resulting in better home and personal hygiene.
> - Other benefits that flow from better health include:
>   - -- More productive labor and ability to work harder for longer hours.
>   - -- Children in school are more alert and are better able to learn.
>   - -- Better nutrition since food utilization is inhibited during diarrhea.
> - Saving in labor and time if water is more conveniently supplied. This frees people to do other things with their time and thus the quality of life can be improved.

A. Measurement of Benefits

Efforts to quantify benefits are difficult:

- Benefits tend to appear not all at once but build up and become evident over time. Longitudinal studies extending over five years or more to prove health benefits are costly and difficult to mount and keep properly staffed.
- In addition,
  - -- a careful experimental design is needed (with control group villages) in order to isolate improvements due to water supply from improvements that have occurred anyway because of other on-going changes;
  - -- complete isolation of the communities under study is not possible; and

-- benefits may be lost or only partially realized if other associated inputs are not also provided.

For these reasons, detailed and expensive efforts to do studies of benefits are generally not favored and are usually not a worthwhile investment of time and resources.

B. Recommendations

A methodology should be developed for documenting benefits from rural water projects. This may be particularly necessary if large national programs are being contemplated. Water projects too often suffer from not being "competitive" with other development activities which can more easily demonstrate "hard" benefits.

Interviewing recipients is relatively inexpensive and should be considered as a method of gaining their perception of health benefits (and other benefits), especially in relation to the other inputs of latrine, health education and community involvement.

If people in a village consider that the water supply project has had considerable benefit in health and other ways, then it probably has. It would be worthwhile finding out more about how and under what circumstances village communities appreciate and perceive the benefits of improved water supply since such studies might provide guides to better planning for community involvement.

Cost effective analysis is considered to be a more appropriate test for investment decisions than cost/benefit analysis in water supply programs. The larger amount of benefits do not always come with the most costly improvement in a system. For example, the provision of a piped water supply to a village through multiple taps or standposts may be expensive and produce few health benefits because other disease vectors remain or intervene as water is carried from the standpipe to the point of use. The extra margin of cost of house connections may then produce multiple extra benefits for a small additional cost. Nevertheless, it is often better to proceed incrementally with a project and to give a village community a chance to improve in a step-by-step process rather than to force too large a forward leap.

The workshop report found that projects tended to be successful when there was a strong commitment backed by sufficient funding to build and maintain water systems. Although the Workshop report on commitment is true, it is limited and, to a great extent, naive. Budgetary constraints are a fact of life in rural water projects and projects should be designed with this in mind. The evidence is that unless communities raise funds internally, systems will not survive. Beyond appointing qualified people, ensuring clear bureaucratic lines of authority, and setting clear, noncontradictory policy, there is little more that AID can reasonably expect from host-country governments.

Adequate evidence was not found to support three other hypotheses, which state that projects are more likely to succeed when:

- Communities are fully aware of the costs and benefits of the alternative levels of service that could be provided and participate in the selection of technologies, subject to existing constraints or available money, labor, and skills for implementation

- More time is available for the promotion process in each community and the links between water quality, water quantity, sanitation, and health education are more fully explained and understood in the community

- Communication with the villagers is not left to the promoter or social scientist but becomes part of the role/behavior of all those involved in the project.

The following hypotheses: that projects were more likely to succeed when detailed plans of actual conditions, including the number and size of villages, the economic base, and sociodemographic characteristics of the country were available, was not supported by the evaluations. Tanzania was one country that prepared such a detailed plan, but the information was not used for water supply development. The cost of extensive planning and rapid demographic changes should be considered before undertaking advanced planning.

IV. COMMUNITY WATER SUPPLY CONFERENCE DESCRIPTION AND REPORTS

The Community Water Supply Conference was held in Marriottsville, Maryland on January 24-28, 1982. The conference objective was to provide guidance on the planning, implementation, and evaluation of community water projects.

The conference included plenary sessions, formal panel presentations, informal individual presentations, and workshops.

A. Participants

There were a total of 78 registered participants and 5 conference contractor staff members at the conference. Participants were selected for their involvement and experience in water supply development. AID Missions identified host country nationals to attend the conference. The list of participants is presented as Appendix A. The following indicates the affiliation categories of the participants:

AID/Washington	30 (7-PPC/E)
AID/Missions	15
Host Country Nationals	10
Consultants	10
Project WASH/CDM	5
MetaMetrics	5
CARE	4
Peace Corps	2
U.S. Department of State	1
South Pacific Commission	1
	83

B. Conference Work Group Reports

A major focus of the conference was the identification of issues, findings, and recommendations based on group review of the six chosen topic areas dealing with community water supply. Each group drafted its initial report, which was then reviewed by at least two other groups, and their comments and suggestions were incorporated into the six final reports summarized below.

1. Planning, Implementing, and Evaluating Community Water Projects

Planning, implementing, and evaluating provide the process framework for any community water project from its conception to its completion. Performed properly, the process should yield a project capable of meeting its long-term and short-term objectives. Planning, implementing, and evaluating are not discrete activities, but are interconnected and mutually reinforcing. Continuing review and evaluation lead to improved policies and strategies and ultimately to better water services to project beneficiaries.

Essential elements in this preproject process include identification of the consensus regarding:

- project objectives
- intended beneficiaries
- government and community support for the project(s)
- economic and technological options
- range of acceptable levels of service
- human and institutional resources
- physical resources, especially water
- complementary resources and possible constraints
- scale, timing, and staging possibilities

Key Issues

The following are key issues for planning, implementing, and evaluating water projects:

- Political. Is the government committed to the success of the project? Host-country commitment to provide resources and qualified personnel over a long period of time is considered necessary to sustain the program.

- Social. Is the community committed to the success of the project? Communities should be aware of the costs and benefits of the proposed system and should be involved in the project from the beginning. Contributions should be applied.

- Financial. Is sufficient cash or other financial resources available to fund the project? Donor assistance?

- Technical. The selected technology should be manageable by the local institution and above all by the communities. Equipment should be locally manufactured wherever applicable.

- Institutional. A local (including private) institution should be involved in the construction and be responsible for the operation and maintenance of the system.

- Objectives. Achievable objectives should be established, and the more concrete those objectives, the better.

- Benefits. What benefits will the project generate? The most apparent benefits are increased convenience and time savings while the benefits to health, although believed to exist, are more difficult to measure.

- Training. A program for manpower development should be provided.

Reliability and Benefits Models

A reinforcing mechanisms seem to exist between reliability and benefits. The mechanism is the willingness of the communities with reliable water systems to provide the necessary support for their operation.

The necessary capital funds are generally beyond the financial means of the rural residents who may not be able to assess the benefits they will receive until the project is implemented and it becomes evident that the benefits outweigh the operations and maintenance costs. Thus capital funds may have to be secured from other sources. Funding requirements are directly related to the technology selected. Field data have demonstrated that the reliability of a rural water system is not a function of the level of technology used; this finding contradicts the view that simple systems are reliable and complex systems are less reliable. A balance between the inputs of the reliability model is desirable to produce the most effective system.

The benefits reaped from a rural water supply system are illustrated in Figure 5. While it is agreed that major benefits are to be gained from improved rural water supply systems, it is extremely difficult to measure or quantify such benefits. Furthermore, benefits tend to appear not all at once, but to build up and become evident over time.

Benefits from a community water supply system can be impaired through inadequate consideration of possible negative effects resulting from the introduction of water supplies. Potential negative effects include wastewater accumulation resulting in the deterioration of the environment and public health, land salinization, and degradation of grazing pastures leading to lower productivity. Such effects can stem from design aspects of the system or from subsequent water management practices. The improved quality of water will not necessarily enhance health conditions unless the whole water supply, delivery, storage system, and end use practices are hygienic from the public health point of view.

Utilization of Limited Donor Resources

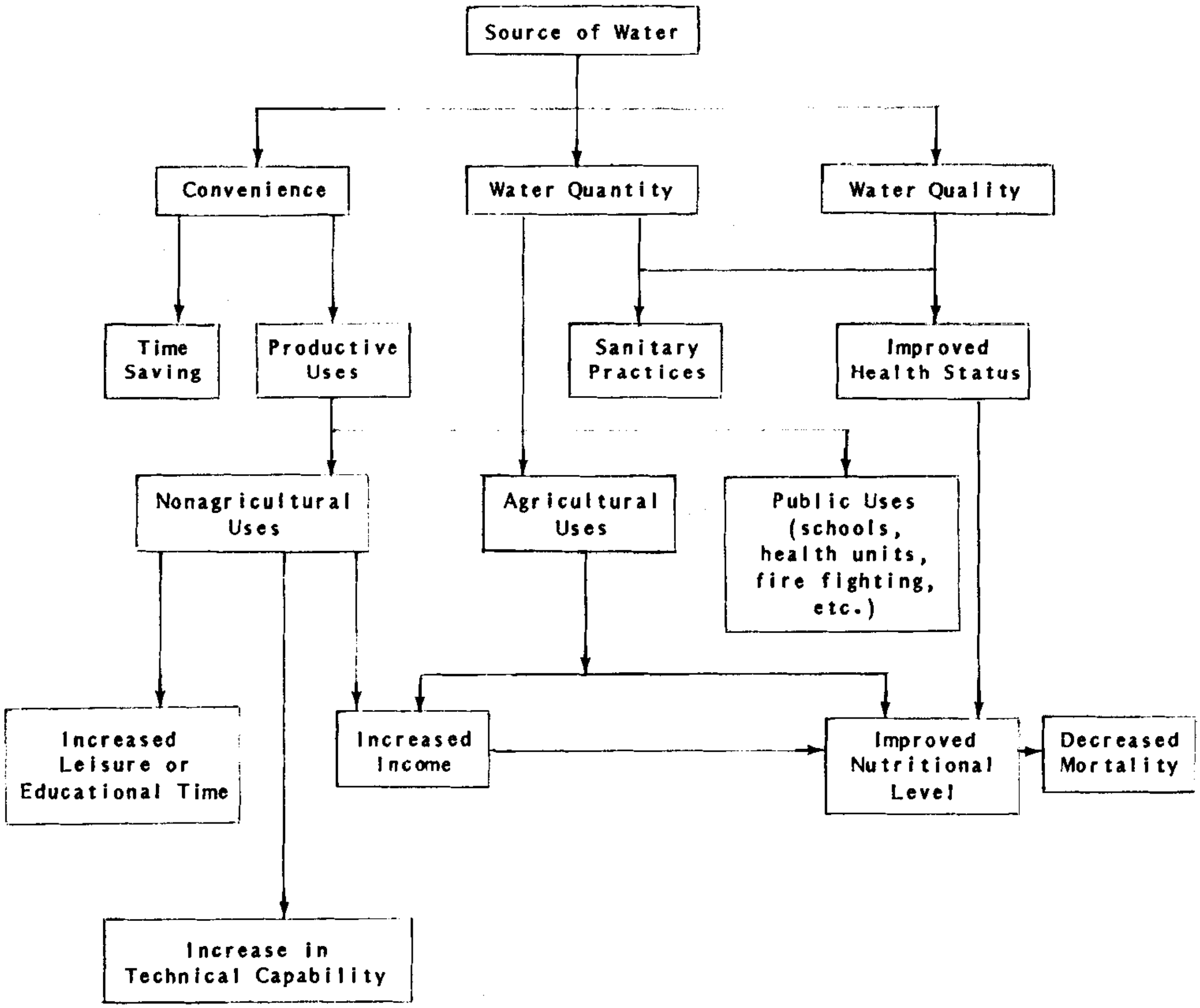
AID cannot possibly respond meaningfully to the full scope of rural community water supply needs at the village or local level. Therefore, we should seek to direct resources toward the development of two essential types of host-country support institutions that are missing in most developing countries. These are:

1. A financial institution which will provide a source of loan capital to cover all or a part of water system construction cost

2. A technical organization to provide assistance in planning, design, construction, operation, and maintenance

The financial agency should be an existing national development bank or the like which would administer a special water supply and sanitation fund. The fund would be administered on a sound financial basis so that the capital would be maintained through loan amortizations.

Figure 5. Water Supply Benefits Model



The technical organization would provide the required expertise in all phases of water supply system planning as well as design. It would supervise the construction to assure adherence to required standards and, most important, operate and maintain the system or provide assistance which would assure a continuously operating system.

AID input would include loans to the national water supply and sanitation fund, technical assistance to the technical organization, and training opportunities for selected personnel.

An example of such an organizational relationships is shown in Figure 6. The example highlights the role of AID in providing assistance to and through institutions.

General Policy Recommendations

1. Broaden the funding base. AID should fund rural community water projects from the Food and Nutrition (rural development) account.

2. Foster projects which will be self-supporting. Water projects should be designed to be self-supporting, with some measure of capital recovery if feasible, preferably through direct payment by the beneficiaries or through some form of cross-subsidy. When feasible, funds collected for operation and maintenance should remain in support of the local water systems.

3. Maximize the impact of scarce AID resources. AID cannot respond to the full scope of rural community water supply needs by direct funding of village or local-level projects. Therefore, we should direct resources toward the development of two essential types of host-country institutions which are missing in many developing countries. These are:

    - A financial institution which will provide a source of capital to cover all or a part of the construction cost

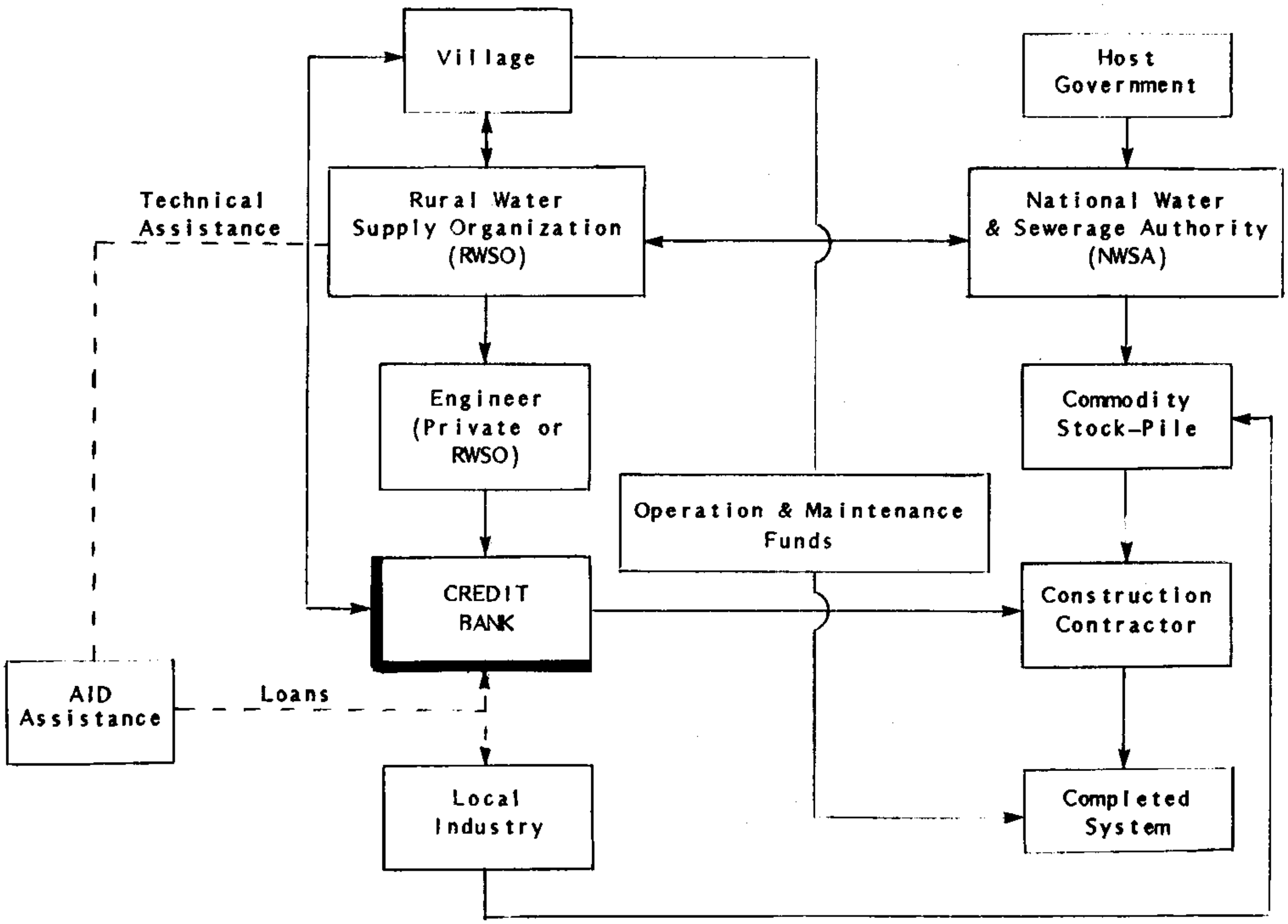
    - A technical organization to provide assistance in planning, design, construction, operation, and maintenance

4. Clarify the relationship of water supply and disposal projects. Whether or not latrine or excreta disposal projects are designed and implemented separately from water projects should depend on the density of the population being served, physical characteristics of the project zone, and per capita water use.

2. Funding and Financing Water Systems

Water and sanitation systems are costly undertakings involving significant capital, as well as continuing maintenance and operation expenditures. To date, national governments have been heavily involved in building and sustaining systems, while the record on maintenance and operation is generally dismal. The difficulty in system upkeep stems largely from (1) a lack of local involvement in and responsibility for water (and sanitation systems), (2) the need to rely on national government

Figure 6. Institutional Model



resources and interest to maintain the existing system, and (3) the need for an institution to support local involvement in water. Given the increase in developing country populations, the need to expand and continue water and sanitation systems, and stagnant government budgets, some form of financing other than government revenues is essential if water and sanitation systems are to remain viable over the long-term.

Local responsibility for maintenance and operation should be developed by generating revenue from the users who want water systems. This can replace or supplement government resources and involve beneficiaries in decisions on locally appropriate technology, site selection, fee structures, and future expansion. In effect, communities (or individuals) identify what kind of water system they want and are willing to support, while simultaneously making continuation of the system viable.

Sanitation systems are more difficult to finance because demand for such service is low. Technologically sophisticated systems are only necessary in densely populated areas as a public health measure. Thus, expenditures for water may subsidize sanitation in urban areas which will continue to claim national resources at least for the short-term.

Cost-Recovery Guidelines

No inflexible rule exists as to the desirable level of cost recovery. As a general rule, the cost-recovery policy adopted should be consonant with the host country's policy unless it is clear that application of that policy will be a burden on the intended beneficiaries. The financial capacity of the recipient must be established with reasonable accuracy to determine how much of the life-of-project costs can be borne by the recipient.

The following guidelines should be considered in establishing the cost recovery program:

1. For household water supply projects, full cost (capital and recurrent) recovery should be the goal. Rates should be structured to include cross-subsidization so as to allow minimum consumption requirements at affordable costs to the lowest income-level beneficiary.

2. For nonhousehold water supply projects the target for recovery of costs over and above the operation and maintenance costs should be maximized but not subject to any predetermined level.

3. Consideration should be given to providing maximum subsidy to sanitation projects. The minimum desired target is that operation and maintenance costs be met. These charges may have to be met through excess charges on water supply.

4. Recognizing that house connections represent a significant project cost, full cost recovery is desirable. However, the mechanism and timing of collection should be project specific.

AID should carefully examine the financial arrangements between a central government and the project's operating entity, particularly in those cases where there are reloans or payment by the operating entity to the central government for donor or central government grants to a project. AID should be aware of and carefully consider the consequences of loans with a substantially shorter term and a significantly higher interest rate than the AID loan. The cost of funds to the Government is a useful guide on Government-granted funds. To the extent that rate structure can generate revenue above and beyond capital and operating expenses, AID should encourage the reinvestment of those funds into new water and sanitation projects or system expansion.

Conservation

In seeking to design water systems that people value and are willing to pay for, communities and project designers must recognize that the systems will also increase consumption. In most areas in which AID is working, conservation should be strongly encouraged to preserve scarce resources, to keep a lid on the capital costs of a system, and to minimize negative impacts on health which result from waste water. In some cases, the need to conserve may limit the amounts of water the system can deliver. Price structures and rates charged (such as increasing block rates) are also legitimate tools for encouraging conservation.

Subsidies in Community Water Supply Projects

Projects for the lower income sectors of the population will normally require direct subsidies from central or local governments or indirect subsidies from the most affluent sectors of the community. Two groups of beneficiaries are considered in this analysis: city slums and rural communities.

City Slums

The inhabitants of slum areas will also often require more sophisticated and costly water systems (including sewage disposal) which will generally require some sort of subsidy. One way of financing slum water systems is through sub-loans to the beneficiaries for the total cost of street distribution lines, house connections, and, where applicable, meters. Central and local governments or city water authorities usually provide the capital financing from grants, development loans or their own resources. The government subsidy would generally include the coverage of the repayment of foreign exchange and administrative costs. In addition, the cost of the major infrastructure facilities will not normally be included in the subloans. These may consist of intake and treatment facilities and truck lines. The cost of these should be recovered through the city-wide water rates. Thus, the higher income sectors of the city--which consume more water and normally are charged with higher rates--will subsidize the provision of water to the slum areas.

Rural Communities

Since most rural villagers are part of a subsistence economy, the government subsidy will have to be higher. The community contribution will normally include free unskilled labor and native materials. In certain instances, it may also include some cash contribution. Imported materials, supervision, and skilled labor will generally be heavily subsidized. Although it is desirable that upon completion of system construction the communities assume full responsibility for operation and maintenance, some inescapable subsidies may still be required for periodic inspections, assistance in major repairs, and provision of spare parts.

Institutional Issues

Evaluations of water supply and sanitation projects have shown that a major contributing factor to the success or failure of a given project is the manner in which a cooperating government, structure, or institution carries our the program. In programs which have not had much success, often no single organization or institution has been vested with responsibility for the program. Either the responsibility becomes blurred or it is spread through a multiplicity of agencies and authorities so that "everyone is in charge and nobody is responsible." Experience has shown that early in the planning stages of water supply and sanitation projects a cooperating country institution should be selected to assume local responsibility for the project. The format will vary from country to country; in some instances a central government agency will be appropriate, in others, a regional government agency might be better, and in yet others a semiantonous or fully autonomous entity will be preferred.

The Lead institution should assume responsibility for carrying out the detailed coordination and planning of the project. In collaboration with the donor agency, this host-country institution should perform the following functions:

1. Establish criteria for site selection and the types of system and levels of service to the supplied, determining which types of systems and levels of service the user public is able and willing to pay for.

2. Establish rate structures and a mechanism to collect user fees.

3. Establish, in cooperation with user organizations at the village or neighborhood level, mechanisms for carrying out operation and maintenance of the system installed.

4. Assure that funding for operation and maintenance is adequate. Such funding may originate with the donor and may cover the cost of spare parts at the onset, but should be incrementally assumed by the users. Spare parts must be available in the area at all times and should eventually be produced in the country itself, if feasible.

5. Undertake the training of women and men who will be responsible for carrying out operations and maintenance and furnishing technical assistance.

6. Assure the availability of needed spare parts and a system of resupply to the local operating agencies.

7. Provide a reliable financial and economic data base to strengthen financial accounting and ensure fair and reasonable pricing structures. Where necessary, technical assistance will be made available to accomplish this.

If adequate local institutions are not found in the cooperating country, it is essential to guarantee their establishment as a prerequisite to implementing projects.

Community Participation

Experience has shown that project success is closely related to the degree of community participation in planning, design, construction, operations, and maintenance phases.

Involvement of the community during the planning and design phases will allow the project proponent to better understand what the community desires and is willing to pay for. Lacking this input, the designer may make costly mistakes by overbuilding (for example, placing in-house water systems in a poor community) or underbuilding (for example, placing hand pumps in a semiurban community that already has equally convenient, reliable sources). Community participation may also be valuable in helping the designer avoid mistakes which have already been made or which might be avoided with better knowledge of the local conditions. For instance, in a rural situation, the location of a shallow aquifer may be identified by local lore; in a semiurban situation, problems occurring with certain types of pumps may already have been identified and thus can be avoided. Nevertheless, most of the technical inputs to a project will still generally come from outside sources.

Community participation in the construction phase of a project may come as cash, labor, or other resource inputs. An unsophisticated rural system may require outside capital investment but should include local contributions of money, labor, or materials. On the other hand, a relatively sophisticated urban system may not be able to draw on a local unskilled labor pool, but should instead require at least partial financing by the local population.

One of the most important areas for local contributions is that of operation and maintenance. While governments may be the major source of funds for the capital costs of water supply and sanitation facilities, there is broad consensus that operation and maintenance should be supported to the maximum extent possible by the local community. While it may be desirable for all parties to share the costs of institutional and infrastructure development and training, in practice, these costs probably will have to be borne by the regional or national government.

Sanitation

While recognizing the need to integrate certain sanitation and health education elements into water projects, from an economic/financial perspective those interventions need to be subsidized and therefore should be limited to what is essential to protect health and the environment.

Improvements to sanitation become more important as population densities increase, whereas rural areas may not even need to invest in sanitation systems. Sanitation systems are extremely expensive to construct and to maintain, and are not perceived as benefits by the individual users. Rather, health improvements are imposed on water project designs by planners who envision a need to protect the community as a whole.

Recommendations on Financing and Funding

1. AID should recognize the multiple benefits of water supply and sanitation projects and thus permit them to be funded from the Food and Nutrition (FAA, Section 103) account as well as the Health Development Assistance account (Section 104).

2. The type of system (well, hand pump, community fountain, household connections) should be affordable by the beneficiaries and appropriate to their expectations as well as their ability to operate and maintain it. This implies the need to involve the community closely in project planning and implementation.

3. Users should always be required to contribute in cash or kind to the costs of maintenance. In the case of simpler systems (for example, wells and hand pumps) they should also contribute cash, materials, or labor to construction costs.

4. The rate structure and specific funding and financing responsibilities (institutional and individual) should be established before the project commences. There must be a clear understanding of and agreement to financial responsibilities on the part of AID, the host government, local governments and agencies, and beneficiaries before construction begins.

5. All Water Supply and Sanitation Project Papers should require strong economic and financial justification, particularly with respect to the issues of recurrent cost financing and system maintenance. Project Papers which do not provide adequate evidence of financial sustainability and local absorption of recurrent or operating costs should be rejected.

6. Water Supply and Sanitation projects should contain the provision for a strong technical institution or authority which oversees construction and establishment of local water systems and which serves as a source of assistance to communities and users associations once they become responsible for on-going operations and maintenance. Wherever possible, existing institutions should be used; where necessary, new ones should be created.

7. AID should seek wherever possible to encourage the development of private loan financing with U.S. Government guarantees as an alternative to conventional loan and grant financing (ESF) of water supply and sanitation projects.

3. Appropriate Technology

Appropriate technology may be defined as the most cost-effective, feasible, and acceptable means to provide community water supply and sanitation services that the users and appropriate authority can afford and are willing and capable of operating and maintaining. It is a technology that works and will keep working. It contemplates the simpler, more easily maintained equipment and systems and requires that the services be convenient, accessible, and reliable. A useful concept to consider is that water systems form a continuum ranging from no water to an adequate, reliable supply of water of a satisfactory quality.

Truly appropriate technology must be carefully designed, properly constructed, and capable of reasonable maintenance. It must be both sensitive and responsive to the human dimension. Failure is more often caused by human action (or inaction) than by selection of a particular inappropriate technology. There is probably no one technology that can be considered a priori as the appropriate technology for all situations. Each situation must be judged individually.

The following are summary case histories describing appropriate technology experiences with water and sanitation projects in Kenya, the Pacific Islands, Somalia, Tanzania, and Tunisia.

Kenya

Kenya has adopted a policy that all rural water supplies should be potable and meet the WHO water quality standard to the maximum extent possible. Since the source of water in most cases is rivers or streams which are polluted, high technology water treatment is needed. Because the high technology is imported, the foreign exchange components are high for both the initial capital cost (66 percent of the total project cost) and spare parts required to maintain the equipment. The government does not have sufficient skilled manpower to operate the systems, so treatment plants are designed to treat a 24-hour water supply requirement in 8 hours. On the average, the government's revenue from water sold to consumers covers only 25 percent of total operating cost. Treated water is provided for human and livestock consumption and irrigation of garden plots.

More than 25 percent of the projects are unreliable. Reasons for breakdowns have been (1) lack of imported spare parts, (2) lack of imported fuel to operate equipment, and (3) lack of skilled manpower to operate the schemes. When a system becomes unreliable, people revert to polluted water, and it takes time to bring them back into the scheme.

Pacific Islands

The Pacific Islands have varied geographical characteristics: some have mountains as high as 8,000 feet with fast-flowing streams and rivers and others are small low sandy atolls with either a very fragile freshwater lens or no fresh water. The rainfall varies between 80 and 250 inches per year. A community/village consists of 200 to 500 people. The gravity-fed system is the first choice in areas having streams and rivers. In other areas, rainwater collection systems with back-up system of shallow wells or boreholes are selected. Windmills are generally used to pump groundwater. After determining the appropriate water source, local villager support is obtained. The local group consists of a church pastor, headman, and women's committee representative. The local group's contribution consists of housing and food for the project personnel, some raw materials and labor. The groups is also responsible for collecting maintenance costs.

Because of great distances between islands, local materials and labor are used to the maximum extent. Systems are simple, and, where possible, corrosion-free materials and natural energy are used for the operation of pumps. Sanitation is considered very important because of the fragile ecosystem and limited land area. Therefore, a piped system is provided primarily to operate pour-flush family latrines.

Somalia

USAID has financed a groundwater development project in West Central Somalia which is an example of a high technology project. Aquifer characteristics are little known and require geophysical exploration; dependable aquifers are found only at great depths (over 100 meters); and water quality is generally poor. Somalia's population is both sedentary and nomadic and both groups receive water. Villages are dispersed and range from 500 to 5,000 inhabitants. Water requirements for grazing stock are an integral part of the project design.

The technical approach uses heavy-duty rotary drilling rigs, pumps with diesel direct-drive, and counterbalance windmills (untested). Community participation was actively sought for selection, design, and maintenance of wells and pumps. The community will also share in the cost of operation and maintenance of the wells.

It is too early in the project implementation to determine significant findings. However, it is apparent that a high technology project will be most vulnerable to delays because of mechanical breakdown. Essentially all of the project equipment must be procured internationally and requires high reliance on fuels for well construction and operation.

Tanzania

Roughly 90 percent of the rural population in Tanzania is without access to a source of safe drinking water. The high incidences of water-borne diseases such as cholera and typhus creates tremendous pressure for provision of a supply of clean water. This effort is impeded by a poor infrastructure, insufficient financial resources, lack of skilled labor and parts, and inflated transportation and fuel costs. These facts necessitate the selection of technology that is simple in construction and also enables the continued operation and maintenance by the local government.

Therefore, special hand-operated survey and construction equipment was designed and field tested. Special attention was required to find a maintenance-free pump. The Kangaroo hand pump, without any hinge points, is used for shallow groundwater wells, and the overdimensional SWN 80 and SWN 81 for deep wells.

Tunisia

CARE is undertaking a project to rehabilitate and equip approximately 900 water points in the poorest provinces of Tunisia where water is scarce and accessibility difficult. The project includes rehabilitation of wells, springs, and rainwater-collection cisterns, as well as the supply and installation of pumping devices, including motors where necessary, and provision for their maintenance. The project also includes health education and latrine components. The public health point of view was applied to achieve a safe water quality.

The Tunisia experience demonstrates that for shallow wells with hand pumps a sufficient quantity of water was the determining factor in user acceptance of improvement and sealing of wells, and also seemed to affect pump longevity. Wells were often forced open and equipment vandalized in attempts to increase access to water. Spring boxes were also breached in attempts to reach more water. Wells sealed and equipped with motorized pumps and having adequate quantities of water were well received and supported by the community and the political sector. Public rainwater cisterns lacked a supporting institution and were not maintained. The latrine program component produced poor results due to poor design that did not motivate users to accept the idea of using latrines.

Technology Summary

The work group discussed the available technology according to water supply sources. Table 5 links technological devices with a summary evaluation of their advantages and disadvantages in each case.

Technology-Based Recommendations

The following conclusions are based on the experience of working group members and reinforced by individual country experiences in Kenya, the Pacific Islands, Somalia, Tanzania, and Tunisia.

1. Exact standards of water quality should not be required; however, all projects must increase the quantity of water over existing supplies to be successful in the eyes of users.

2. Technology using local resources to the maximum extent possible should be encouraged.

3. Where topography and distance permits, elevated sources with gravity-feed systems should be used.

4. Where pumping is required, renewable power should be used whenever practicable, such as windpower (windmills), manpower (hand pumps), and solar power.

5. The use of low-cost shallow wells and hand pumps should be encouraged in rural areas.

6. Materials and equipment which can be maintained by the local communities should be used.

7. There should be a central government agency or institution from which communities can obtain assistance in securing operating supplies, repair parts, and maintenance service.

8. Major emphasis must be placed on the continuing operation and maintenance of water supply and sanitation systems.

9. Standardization of technology and hardware should be encouraged.

10. Local communities should participate in the design and construction of water supply and sanitation systems.

Table 5. Technology Summary

Rainwater Catchment	Advantages	Disadvantages
Individual Private Cisterns	1. No pumping systems required 2. Gravity feed possible 3. Easily accessible 4. Low cost 5. Simple technology 6. Good quality water	1. Rainfall not always sufficient 2. Supplementary system 3. Inlets need protection 4. Catchment areas must be kept clean 5. Rainwater separators to reject first rain may be needed 6. Simple roofs of leaf and similar materials unsuitable
Individual Private Natural Catchment and Storage	1. Easily accessible 2. Low cost for overall maintenance	1. More pollution likely 2. Lower quality water 3. Frequent cleaning required 4. Greater land area required
Communal Underground Storage with Paved Catchment Areas	1. Larger storage capacity	1. High cost 2. Pollution likely, so routine disinfection required 3. Management required for maintenance 4. Low accessibility, and water must be carried
Communal Underground Storage with Natural Catchment Areas	1. Low cost/m^3 storage	1. Water quality doubtful 2. Protection of area and regular maintenance required 3. Least desirable option (except where natural remote rock catchment area exists)
Surface Water Rivers and Temporary Springs, Small Dams	1. Gravity feed 2. Minimum maintenance 3. Greater volume and variety of water usage possible	1. Construction sometimes difficult with high costs 2. Vulnerable to pollution 3. Possible breeding areas for vectors of disease if not properly managed 4. Supply may be variable 5. Possible eutorphication (algae-water hyacinths)

Table 5. Technology Summary (cont.)

Surface Water (cont.)	Advantages	Disadvantages
Subterranean Dams	1. May be appropriate in arid areas 2. May be constructed with hand labor	1. Geological knowledge required 2. Subject to pollution
Ground Water		
Upland and Lowland Springs	1. Gravity feed (if upland) 2. Usually good quality water 3. Low cost construction and maintenance	1. Water may be highly mineralized 2. Yield may be limited 3. Proper design and development required to avoid growth of unsanitary areas around spring
Hand-Dug Wells (large diameter)	1. Generally low-cost construction and maintenance 2. Cheap if less than 7 meters deep 3. Yield may be increased by infiltration galleries or deepening	1. Potential for contamination 2. Possible danger during construction 3. Construction is time consuming 4. Transport of heavy lining materials 5. If depth over 7 meters, construction becomes more expensive (need for dewatering equipment)
Hand-Drilled Boreholes	1. Simple technology 2. Few skills required 3. Least expensive construction 4. Rapid construction	1. Difficult to penetrate hard rock 2. Hand pump required 3. Manual drilling difficult over 25 meters
Machine-Drilled Boreholes	1. No limit to depth 2. Water usually safer 3. Rapid construction	1. Very expensive operating costs 2. Skilled operators required 3. Pump required
Hand Pumps	1. Low cost 2. Appropriate for boreholes and hand dug wells serving small number of people (less than 200) 3. Possibility of local manufacturing	1. Not appropriate for large communities 2. Breaks often if not properly maintained 3. Parts are difficult to obtain if not manufactured locally

Table 5. Technology Summary (cont.)

<u>Ground Water (cont.)</u>

Windmills	1. Energy-free low maintenance 2. Continuous pumping with suitable wind velocity (5 mph)	1. Does not operate without sufficient wind 2. Pumping capacity limited 3. Under certain atmospheric conditions corrosion can be a problem
Diesel Fuel Pumps	1. Unlimited output 2. Unlimited depth of well	1. High operation costs (fuel, trans0 portation) 2. Relatively sophisticated maintenance
Electric Pumps	1. Unlimited output 2. Unlimited depth of well	1. Operational costs relatively high 2. Limited application 3. Relatively sophisticated maintenance
Solar Energy	1. Energy free 2. Relatively low maintenance 3. Easy assembly	1. Limited application 2. High capital costs at present time 3. Relatively fragile and easily damaged

11. Local communities must participate in the operation and maintenance of water supply and sanitation systems.

12. In certain situations, high technology solutions may be the most appropriate; although motorized pumps are more expensive than hand pumps, they can provide the best results for large numbers of users.

13. The selection of technology must provide some improvements in convenience and reliability at a cost to the communities which they are willing to bear.

14. The major limiting factors in determining appropriate technology are the cost of building, operating, and maintaining systems, the ability of institutions to design and build systems and of the country's infrastructure to support the systems, and the willingness of the country to sanction the needed imports to maintain the system.

Policy Recommendations in the Area of Technology

1. Appropriate technology should be defined as the most cost-effective, feasible, and acceptable means to provide community water supply and sanitation services that the users and appropriate authority can afford and are willing and capable of operating and maintaining.

2. AID should contribute to increased indigenous capacity for operation, maintenance, and repair of water systems. The probability of project success will be increased by stressing host-country standardization of equipment. When it is not possible to manufacture this equipment within country, AID should relax its source and origin requirements.

3. AID should encourage, through financial incentives if necessary, host-country ministries to provide training and to develop and improve their capacity for inspection, collection, and evaluation of consumption and operating data (which could lead to system redesign and improvement).

4. In the approval of projects, AID should stress the importance of selecting appropriate technologies which provide reasonable improvement in the accessibility and reliability of water systems. These factors are generally more important than improved water quality in community acceptance and project viability.

5. Hardware development for improved water systems should be carried out in host countries and be limited to their priority needs.

4. Assessing and Affecting Institutional Capability

Before approving a proposed community water supply and sanitation project, the decision-maker needs to be sure that the project meets the following criteria:

- Can be implemented according to the construction schedules, cost estimates, and technical standards contained in the project proposal

- Will allocate the resources to communities that have demonstrated strong demand for proved water supplies

- Will result in a reliable, continuing water supply service for the estimated life of the water supply investment, assuming no extraordinary external interruptions such as natural disasters or civil war

The institutional analysis section of the project proposal should provide this assurance by identifying all institutions which will have a critical impact on the outcome of the project. These institutions may range from policy-level government agencies to village-level committees, may include private sector as well as public sector organizations, and may even be informal associations, such as women's marketing clubs in Africa, as well as formal organizations. The institutional analysis is, in effect, an evaluation of the ability of critical organizations to deliver satisfactorily on their responsibilities under the project. It follows that the scope of institutional analysis should fit the complexity and size of individual projects.

For most countries where AID operates, in-country institutional capability at the time the project proposal is drafted is less than optimal to carry out the project. A systematic assessment of key elements of institutional capacity is necessary before one can determine (1) the existence of a minimal critical capacity for proceeding with the project and (2) the areas that should be targeted for institutional strengthening. Where appropriate, a good institutional analysis for an overly ambitious project may result in a revised project whose primary objective may be the strengthening of institutional capacity rather than a large-scale water supply project.

Assessing Institutional Capability

It is recommended that the issues identified above be addressed in the project planning, design, and implementation process through the conduct of a detailed assessment of institutional capability combined, as appropriate, with activities to strengthen institutional capabilities.

For each proposed component of institutional capability to be examined, consideration should be given to the existing outputs of the systems or services being explored so evidence of effective institutional capability can be demonstrated. Prior to carrying out assessment activity, critical outputs should be identified. This identification should be based upon analysis of the level of complexity of the institution and of the specific project being proposed. Once identified, the acceptable level of these outputs should be defined operationally. After assessing the individual components of institutional capability, a single integrated determination of institutional capability should be developed based on a combined analysis of outputs which weigh the various elements analyzed to determine an appropriate optional course of action. These options could include institution-building activities as a project element, development of an independent project to improve institutional capacities, or a recommendation to defer project funding.

In general, institution(s) must be able to operate in five functional areas (1) policy, planning and evaluation; (2) operations; (3) commercial; (4) financial; and (5) administrative support.

The following outline of topics should be given consideration, as appropriate to the specific institution and water supply activity, in the course of an assessment of institutional capability:

Policy Planning and Evaluation Functions

- Formulation of policies and plans on the national, regional and local levels
- Implementation of plans and programs in accordance with obligations and constraints on institution
- Establishment of financial plans consistent with available funds
- Verification that institution's management conforms to established plans and programs
- Evaluation of variations in planned and implemented programs and establishment of reasons for failures and suggestion of future solutions
- Evaluation of appropriate technology and environmental aspects in project planning
- Evaluation of projects with regard to energy and water sources in terms of cost and short-term and long-term availability of these sources in project planning
- Verification that all relevant departments and disciplines are involved in the preparation and review of all policies and plans

Operations Functions

- Project Management Subsystem
  - Preparation of studies and project documents including technical, financial, and economic considerations
  - Completion of work in accordance with standards of quality, performance, deadlines, and cost
  - Development of operation and maintenance information on performance in order to control and evaluate
- Operation Subsystem and Maintenance Subsystem
  - Establishment of services to meet conditions of quality, quantity, continuity of service, coverage, and costs

- Establishment of services to maintain condition for adequate operation and performance, by providing services in a stable, continuous, and efficient way, and maximizing economic life while minimizing cost

Commercial Functions

- Monitoring the usage of water sewerage services to determine fair distribution of services
- Development of invoicing procedures for services rendered to consumers and maintaining of records

Financial Functions

- Generation of financial resources for operation and expansion
- Optimization of application of financial resources
- Control of financial implementation of institution's plan
- Ensuring continuing information on economic/financial status of institution

Administrative Support Functions

- Human Resource Management and Development Subsystem
    - Establishment of policies, standards, and procedures for evaluation and classification of positions, selection, recruitment, performance appraisal, training, social welfare, occupational safety, and employee relationships
- Supplies Management Subsystem
    - Maintaining adequate materials, supplies, and spare parts
    - Establishment of purchasing procedures that take advantage of the market in relation to price, quality, and conditions of payment and delivery
    - Establishment of suitable administrative procedures
    - Establishment of a system of information and materials control
- Transportation Management Subsystem
    - Provision of planning, organization, programming, and control of operation and maintenance of transportation systems.
- Public Relations Subsystem

-- Motivation and education of community to participate in planning, construction, operating, utilizing, maintaining, and managing services

-- Motivation of institution personnel to achieve greater participation in accomplishing institutional goals

Assessment Methodology

The assessment process for institutional capability should examine the above categories using a low-cost and simple methodology. This should aim at making use of procedures suitable for the evaluation of the managerial as well as technical viability of the institution concerned. While focus would be on policy making for national institutions, it could be shifted to operational or other support functions for local or community levels.

It is recommended that the following general methodology, which places emphasis on the development of an institutional history and using identified outputs as indicators, be adopted for the assessment of institutional capacity. It is understood that a full analysis could involve a large, national implementing agency, as well as small community-level groups organized to build, operate, and maintain water systems. Many of the prescribed activities do not apply to the smaller, local institutions. The general procedure is one that would include the following:

- A series of interviews with personnel within the institution, including senior management, technical experts, training specialists, financial staff, administrative staff, and paratechnical staff/skilled tradesmen

- A series of interviews with individuals outside the institution, including representatives of other governmental organizations and other donors, local authorities, and users of the services

- A review of the organizational structure of the institution, examining operating division structure, staffing pattern, position descriptions, and so on

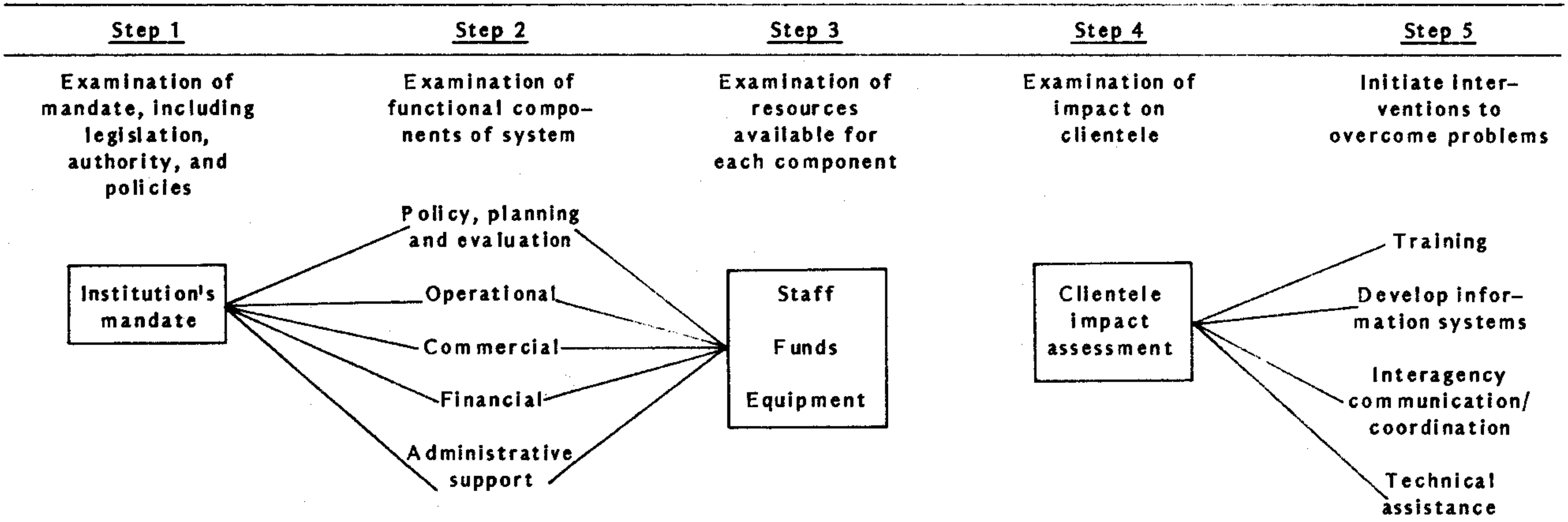
- A review of records, studies, and plans

- Site visits to planned operations projects designed or implemented by the institution or under the administrative or managerial jurisdiction of the institution

- Field visits to evaluate the level and quality of assistance provided by support facilities, including laboratories, maintenance shops, motor pools, warehouses.

Figure 7 suggests a systematic approach to an institutional capability assessment.

Figure 7. Schematic on Systems Approach to Institutional Capability Assessment



Notes on schematic: In assessing institutional capability, it is recommended that a systems analysis approach be used. Five analytical steps are proposed:

Step 1: Examination of institution's mandate, including legislation, authority, and policies

Step 2: Examination of components of the system: policy, planning and evaluation; operational; commercial; financial; and adminstrative support

Step 3: Examination of resources available for each institutional component (staff, equipment, funds, etc.)

Step 4: Examination of impact on clientele

Step 5: Review information gathered during Steps 3 and 4 and initiate various interventions (e.g., training, developing information systems, technical assistance) to overcome problems

Strengthening Institutional Capability

Upon completion of the assessment discussed above, certain strategies should be considered for strengthening the institutions concerned. They may originate from one or more of the five functional areas. Strategies that might be adopted to strengthen the institution include the following:

Training

In far too many cases, developing countries rely on the existing educational and training institutions of the country or of donor nations to provide their human resources. This has often proven unsatisfactory due to the absence of a carefully planned training system which is based on actual needs and long- and short-range objectives. Any training system must take into account training needs, at all levels, with particular emphasis on effective training at the community level. A complete training system should have a curriculum based on carefully drawn objectives, a complete set of training materials based on the curriculum, training of trainers, and evaluation of training outcomes. All aspects of the training system need to be related so they reinforce each other. For example, the results of evaluation efforts need to be fed directly to the designers for any changes in content. The following areas of training deserve special attention:

- Training of trainers The establishment of training of trainer programs to supply institutions with trainers for their programs is a primary need. This means that engineers, managers, financial and accounting staff, technicians, skilled labor, and so on must all be trained as trainers. This includes not only their role as trainers in structured training situations, but also the preparation of foremen, supervisors, and professionals for their trainer roles in their day-to-day on the job training responsibilities.

- Management training. In most institutions, personnel advance by seniority in their particular skill area. Most times they receive no training for their increased management responsibilities. Each institution or agency must have a program for employees to receive training on decision-making, delegating authority, time management, motivating subordinates, crisis management, and similar types of management activities. Management training needs to be tied to issues of incentives and career advancement.

- Training skilled technicians. A major need exists for training due to the lack of skilled technicians to operate and maintain equipment, facilities, and systems. This might include the caretaker of a springbox or hand pump as well as the electrical, mechanical, and chemical technicians operating and maintaining more sophisticated systems. This type of training is particularly appropriate at the local level.

Development of Management Information Systems

To strengthen management capabilities for ensuring effective project implementation, a management information system (MIS) should be installed. Components of this system must incorporate institutions at all levels that will be involved or significantly affected by the proposed project. The design of a management information system should serve the purpose of identifying obstacles to project implementation and pinpoint where corrective action is necessary. The system should provide continual feedback as to goals achieved toward the implementation of the project and its eventual impact.

There are many components that could be included in the MIS, depending on the needs of the institution and the complexity of the projects. Some examples of useful components of such a system include delineation of project responsibilites, milestone chart of project implementation, daily reviews of work, weekly reporting sessions, workshops for periodic review of overall progress, quality circles, progress reports, procurement scheduling, inventory and equipment control, financial statements, and data collection instrument (items measuring impact).

Enhancing Interagency Communication and Coordination

The lack of communication and coordination between various institutions involved in water and sanitation sector efforts has been well established in many projects. Efforts should be made to involve the National Action Committees (NAC) in each country early in any new efforts and develop communication and coordination mechanisms for each significant step in an effort. Where local circumstances do not permit the NAC to assume this role, other methods must be developed.

Providing Technical Assistance

A fourth major area for strengthening programs is the provision of technical assistance. Three major areas have already been pointed out, namely training of trainers, and developing management skills and skilled technicians. However, in most countries there will be other areas needing specific technical assistance. Importation of specific technical assistance should be sought to bring the institution's personnel up to a prescribed level of performance.

Key Findings and Recommendations on Institutional Capability

In reviewing institutional capability, the following items and recommendations were identified:

1. The commitment of the host government to community water supply is critical to ensure program or project success.

2. Successful project implementation requires that clear lines of legal authority exist which clearly define administrative, financial, and technical responsibility. In cases where more than one organization is involved there must be a working agreement to ensure coordination.

3. Host-country organizations responsible for project implementation should be subjected to an in-depth institutional analysis during project design to assess established capacity in five functional areas: planning, operations, commercial, financial, and administrative support. The institutional assessment should include organizations with responsibilities for secondary aspects of the project such as health education and wastewater management.

4. Training needs, as identified in the institutional analysis, should be directly addressed in the project design or be provided for in a specially designed complementary training project. In addition to the traditional concern of training engineers, emphasis should be given to the training of training specialists, administrative staff, managerial staff, and skilled labor.

5. Projects should include a management information system which will provide an ability to diagnose conditions and information to develop solutions to performance problems. This information system should include items such as progress reports, procurements, operational schedules, material inventory, equipment control, and financial statements.

6. Successful project implementation requires that provision be made for the long-term operation and maintenance funds to finance both local and foreign currency costs.

5. Developing Systems That Communities Value

The following assumptions are made about the conditions that support the development of a water supply for any given community.

- The host government has made a commitment to the development of community water supplies as evidenced by systems established for the procurement and distribution of equipment and supplies, including replacement parts; funds appropriated to cover local costs; and positions for required personnel

- A preliminary study has determined the availability of a water source and determined the approximate cost of a system acceptable to members of the community

- No reasons exist to believe that maintenance costs of the project would be beyond the capacity of the community either to bear in their entirety or to share

Values and Their Determination

The values communities place on water supply are major determinants of their willingness to participate in a project; the major yardstick of the value a community puts on a water supply is willingness to pay for installation and maintenance. Values are best determined in relation to various uses of water. A sample matrix comparing uses with values is presented as Figure 8. The project planner could fill in the cells with specific information for a given locality. Questions can be designed to elicit community input during the design stage of project implementation. Their purpose would be to find out what community members think about their present water supply and how they would respond to an opportunity to change this supply.

If we assume that everyone already has a source of water, people are then more concerned with the tangible qualities of water, such as taste and color and temperature than with its accessibility (distance, convenience) or indirect benefits (health).

Those preferences show up particularly in values attached to water use for drinking and cooking.

Figure 8. Relationships of Community-Perceived Values to Uses of Water

Value	Drinking and Cooking	Washing (Utensils and Clothes)	Bathing (Body, Hands, Anus)	House and Yard Cleaning	Home Gardens	Water for Animals	Small-Scale Industry
Physical characteristics	____	____	____	____	____	____	____
Distance	____	____	____	____	____	____	____
Reliability	____	____	____	____	____	____	____
Perceived health benefits	____	____	____	____	____	____	____
Convenience	____	____	____	____	____	____	____
Equity	____	____	____	____	____	____	____
Income generation	____	____	____	____	____	____	____

People place high value on the physical qualities (color, taste, odor, temperature) of water they use as opposed to bacteriological quality. They are often willing to bypass a more convenient source of water to obtain water having certain physical qualities they value. On the other hand, where water is a matter of basic survival, people are willing to use water of almost any quality to meet their needs. The basic needs are outlined below:

<u>Drinking and Cooking</u>

Although water for drinking and cooking is a matter of basic survival, people have preferences regarding water they use for drinking and cooking and exercise their preferences when they can choose their source of water. The preferences expressed by consumers indicate that they place great value on water that tastes clean, smells good, and is both cool and soft.

Washing (Utensils and Clothes)

Laundering clothes and washing kitchen utensils consume a large percentage of domestic water. Most women wash their dishes, pots, and pans at home, even if facilities are primitive and water scarce. Values are also attributed to the softness of the water (savings in soap, quantity of the water and energy expended for rinsing). The social contacts in public laundering places are valued by women in many cultures where their activities are confined to the home. In other societies women prefer to launder in the privacy of their homes. Sometimes women prefer to wash in streams and canals because the large volume of water available makes washing or rinsing easier. Behavioral patterns related to values surrounding water for washing utensils and clothes need to be understood to plan and design an acceptable system which will be used and valued.

Bathing

Water for bathing is valued chiefly if it is available in sufficient quantity, although many populations have adapted to extremely small quantities of water for this use. Because quantity is the chief value, polluted streams, rivers, canals, and irrigation ditches are used for bathing in many parts of the world. Anal cleansing in some societies may be practiced in rivers and streams where water is relatively abundant. Where water is scarce, having it available at the house even in small quantities may be more highly valued. Thus, distance, reliability, and convenience are also highly valued. In the case of infants and elderly persons and, in some societies, all adult men, bathing at the house is highly valued and a quantity of water sufficient for their bathing needs is required. Again, distance, reliability, and convenience are important. Handwashing requires that at least a small quantity of water be available at the home.

House and Yard Cleaning

The physical characteristics of water used for house and yard cleaning are not important. In fact, wastewater from cooking, washing, and bathing is often used for house and yard cleaning tasks. Frequency of house and yard cleaning may be dictated by distance or convenience when waste-water is not used. While this water use may not be important relative to others, it may assume disproportionate importance in some settings, as for example in Laos, where sprinkling down dusty temple grounds may be considered more important than watering animals or gardens.

Home Gardens

There is a general willingness and desire in communities to cultivate home gardens. Home gardens can have economic as well as nutritional benefits for rural households. To realize these benefits communities value convenient and reliable water systems.

Water for Animals

Animals' need for water can be divided into consumption and cleansing requirements and do not need to meet human standards. The water quality needed for animal cleaning will vary over a wide range depending on the animal and where it is kept. The most important factors or requirements of water for animal drinking needs are sufficient quantity, reliable availability, reasonable distance, equity to meet the needs of each household, and safe temperature.

Community Commitment and Project Development

Commitment to building, using, and maintaining new water supply facilities is best assured when communities actively participate in projects. Using a dialog approach, agencies should encourage communities to play a major role in (1) defining their existing situation, (2) choosing among technically feasible alternatives, (3) determining methods of implementation, (4) evaluating the form of community contributions, and (5) setting up social controls for continued use and maintenance.

The optimum use of scarce resources to gather information requires that water supply and sanitation agencies coordinate their activities with other entities such as health clinics, agricultural extension programs, community development agencies and schools, which already have trained (or trainable) people at the village level. These persons are usually experienced in promotion and extension, and they are the crucial link between the agencies and the communities.

The facilitators must be at least minimally trained in social science techniques in order to provide planners with information about community attitudes, perceptions, preferences, and doubts. Identification of projects will require knowledge of where such personnel are available. Women, as primary water supply users, should be the main source of information in the interviews. This initial contact with the women could provide a basis for their continued involvement throughout the project.

Community commitment is enhanced when the designed projects meet community needs and values. How do the community members perceive their environment? Do they think of it as a healthy place to live? What are their criteria for evaluating a good or healthy environment? Do they see a relationship between water supply and good health? Do they view water supply as a problem at all? If they do, why is it a problem and how important is it in relation to other perceived problems? Existing practices relating to water use and preferences for improvements should be investigated. What are the various community uses of water? What characteristics of water supplies are valued for each use? What are the problems associated with obtaining water? What level of service is desirable and what is acceptable? What are the perceived constraints in realizing the desired improvements? Various techniques can be used to obtain project development information. These include direct observation of water-carrying tasks and water-reuse practices, indirect observation of personal hygiene and latrine use habits, interviews with local leaders and individuals involved in sanitation programs, informal conversations with local store owners and craftsmen, and observation of the daily life of the communities.

Willingness to Pay

The most direct way to establish the value placed by the community on an expressed need is the willingness to contribute funds, labor, or materials to the initial system and to agree to regular or special payments for operation and maintenance of the system.

Supplemental indicators of the communities' commitment to pay can be derived from an assessment of past efforts (history) of community projects. For example, has the community worked collectively through farmer cooperatives, adult groups, and youth groups to build schools, roads, health clinics, or managed community-wide projects? How is the community organized and how are decisions made? Has the community collected money for past projects? How are collective funds managed and who decides how the funds are spent? Another important consideration is the economic base of the community and whether or not the community can actually afford the costs of the project.

To determine the extent of the community's willingness and ability to pay, a series of dialogs with community leaders and primary beneficiaries (women) should be undertaken. The dialog should bring out the felt needs of the community, among which may be an expressed need for greater availability of water. If it can be established that the need for a more convenient water system has high priority, the dialog can be narrowed to discussions of what the community as a whole and the various identifiable segments feel they need in terms of type of installation, frequency, and kind of use.

Willingness to pay must also encompass in-kind contributions such as labor, accessible natural resources (sand, gravel, clay, lumber, and so on), and the management and organizational time required for the design, implementation, and continued operation and maintenance of the system. Thus, willingness to pay can include voluntary labor and the provision of a village member to operate and maintain the system or the time that the village committee spends in necessary support of the project.

The best way to measure how much a community values a water supply is to find out how much it is willing to pay in cash, labor, or in kind to build and to maintain the system. AID's experience also indicates that people are more likely to value and care for water systems to which they have directly contributed in cash, labor, or in kind.

Recommendations on Developing Systems That Communities Value

1. In preparing community water supply projects, communities should be contacted early in the process to determine their commitment to and value placed on water supply systems. The extent of the analysis will depend on the size and complexity of the project. These contacts will be made for community water projects in both rural and semiurban settings.

2. The project planning process should provide sufficient flexibility to accommodate community-based values in determining the organizational and technical aspects of community water projects to produce social, economic, and health benefits.

6. Determination of Appropriate Components for a Water System

The determination of the appropriate components of a water supply system is not a task which lends itself to the formulation of inflexible, over-generalized guidelines. The particular circumstances of the case in question should be considered in a multistage planning process. There are three basic steps to this planning process:

1. Needs Assessment. The needs assessment should focus on the perceived needs of the community. Water must be perceived as a priority problem. If it is, the nature of the perceived problem with the existing source must be defined. In particular, it should be determined to what extent the problem is perceived as one of available or accessible quantity as opposed to quality. System design should be consistent with local perceptions so as to ensure community interest and support. In some extraordinary cases, need could reflect instead the concerns of groups outside the community such as public health officials.

2. Feasibility Studies. Feasibility should be assessed objectively in the following dimensions: technical assessment/sanitary survey; financial analysis/determination of the appropriate level of service; and social analysis/assessment of community organization and capabilities.

3. System Design. A water supply system design should then be prepared that conforms to the perceived community needs and the social, economic, and technical conditions.

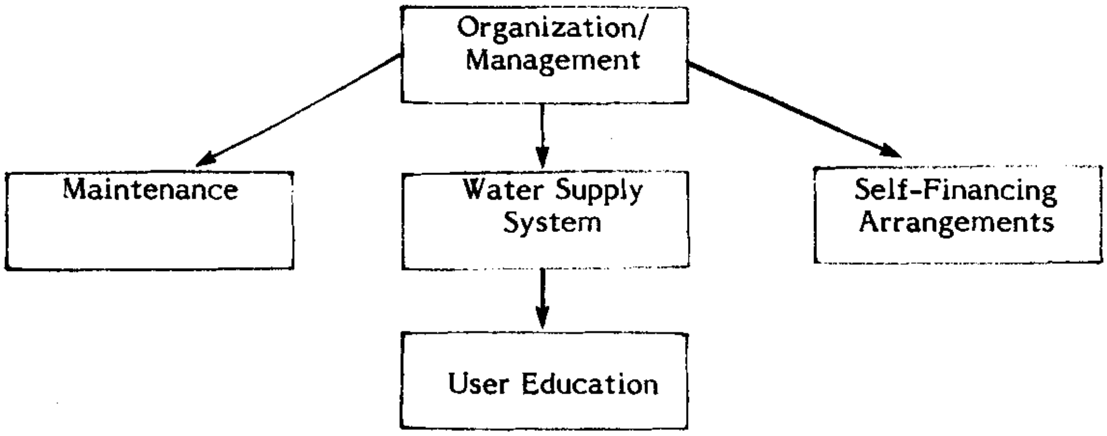
By going through such a process, one can determine the type of project which will be both technically sound and valued by the community. This differs from an approach based on rigid rules concerning the inclusion or exclusion of a wide range of components in addition to the water supply system itself. It seeks a minimally acceptable system which includes the key components of all water supply projects. This basic system could then either stand by itself or be coupled with other activities depending on the circumstances of the case in question.

Minimum Project Components

The minimally acceptable water supply project (Figure 9) includes the appropriately designed water supply system itself, additional components essential to ensure that system's long-term viability (provisions for system maintenance, maximum self-financing, and the necessary community, regional, national organization), and user education and training.

Provision for monitoring and evaluation is essential in the organization of the project. The extent and type of monitoring or evaluation will depend on the need for information. At the community level, a minimum need exists for basic monitoring to observe important problems and plan for improvements. At the government/AID level, monitoring and evaluation might include analysis of critical indicators of project operations or discrete project objectives (for example, health impact, income generation), and development of a mechanism for continuous replanning based on this analysis.

Figure 9. Minimum Requirements for a Water Supply Project



Provision for system maintenance ensures long-term viability and should be given high priority. Maintenance education should begin at the initial stages of program design to reinforce the concept of community participation and commitment and expedite construction by providing skilled workers to assist in the construction effort. In addition, this provides the "hands-on" experience necessary for repairs once the system has become operative. Every effort should be made to select technicians likely to stay in the area. The educational program should emphasize preventive maintenance, to avoid surprise breakdowns, allow sufficient time to obtain technical assistance, and limit system downtime.

Self-financing arrangements to cover recurring costs of operation, maintenance, and long-term replacement of capital investments are also essential, and could include government subsidy, proportional user fees, taxation, nonwater-related cooperative activities, and water related cooperative activities.

A level of user education appropriate to the system and its design features is necessary to protect its viability and maximize the system's social and health benefits. This is not health education in the traditional sense. Some examples of user education could include instructions on how to eliminate direct and indirect contamination and use proper withdrawal and transfer techniques for open well systems, or information on the importance of drainage and flow monitoring in standpipes.

Depending on the particular circumstances of a village, region, or country, the minimally acceptable system could constitute the entire project intervention or could be coupled with one of several types of ancillary activities. This could be accomplished either within the confines of a single integrated project or in parallel projects. Actual project interventions could thus take on different emphasis, depending on which, if any, additional components are linked to the basic water supply project.

Ancillary Activities

Any ancillary activity would depend on the positive resolution of four elements: (1) perceived needs of the community, (2) relevance to water project and criteria for selection, (3) institutional relationships, and (4) long-term financing. Should these elements not be resolved at the outset of the water activity, then the long-term viability of the water project would be the primary focus of action, with ancillary activities phased in later. Three major ancillary activites to which water supply could be linked in the project are addressed below.

Health Education

Health education for a water project involves community education on the relationship between illnesses and water sources and the necessary measures to avoid these illnesses. Approximately 80 percent of diseases in developing countries are water or sanitation related; however, better water systems do not always result in improvements in health. A lack of information and knowledge concerning proper hygiene can minimize any impact a new water project might have on health and could even have a negative effect. A health education program must be planned in conjunction with the project, beginning early and extending ideally over several years after project completion. Many health education programs for water projects have been inadequately developed and implemented with insufficient resources and discontinued too soon. Successful implementation requires skillful planning, development, and application of appropriate education methods, as well as a sharing of responsibility among all those concerned: government officials, engineers, educators, community leaders, and community workers. It is important to remember that the true value of some educational efforts cannot be measured in terms of immediate and specific achievements. It often takes as long as a generation before patterns of behavior change can be seen.

Sanitation

Ancillary activities involving sanitation include elimination of waste material (human, animal, water, garbage, and environmental hazards), environmental control (stagnant water, vector control, and habitat and source protection), and food protection. The degree to which these activities would be incorporated into the water activity would depend on interest or need in the community and the community's willingness to finance long-term interventions.

Income-Generating Activities

The introduction of a viable and stable water system generally results in an increase in available manpower as well as a valuable developmental resource: water. Water projects need initially to address income generation to the extent that available fiscal resources fall short of the financing necessary to create and maintain a viable water system (i.e., investment, recurring costs, operation and maintenance, and replacement). Once long-term viability has been guaranteed, then efforts should be explored to capitalize on the developmental opportunities created by water availability.

Recommendations on Determining Appropriate Components for a Water System

1. The components to be included in water supply projects can only be determined on a case-by-case basis.

2. The minimally acceptable water supply project shall include the water supply system itself; provisions for maintenance, maximum self-financing, and user education or training; and the organization and management required to ensure long-term system viability.

3. The inclusion of ancillary components in a water supply project should be decided on the basis of the needs assessment, the feasibility studies, an indication of community interest, and prospects for long-term support. Such ancillary components include, but are not restricted to, those of health education, sanitation, and income-generating activities.

4. The training of local staff, where necessary, should be built into all phases of project activity to ensure the long-term viability of the water systems.

5. The development of host country manufacturing capability for the various components of water systems may contribute to a reduction in maintenance-related difficulties; however, the expeditious procurement of supplies is the key to minimizing interruptions in service. This responsibility should be given to the system operator.

C. Opening Plenary Session

On Monday, January 25, 1982, the conference began at 9:30 am with a plenary session. Robert Berg, Associate Assistant Administrator, PPC/E, welcomed the participants to the conference. Dr. Richard Blue, Chief of the Studies Division, Bureau for Program and Policy Coordinations, Office of Evaluation presented an overview of the conference, the purpose and planned activities. Mr. Berg introduced Ambassador John McDonald, the conference keynote speaker and U.S. State Department Coordinator of the United Nations Decade on Drinking Water and Sanitation.

Ambassador McDonald presented the history of the U.N. Water Decade beginning with the Habitat Meeting in Vancouver. Ambassador McDonald stated that the third world has accepted the goals of the Water Decade. Over 60 countries have action committees at the ministerial level and 90 have national strategies. Water supply is seen as more important than doctors.

He noted that the United States has accepted and supports the U. N. Water Decade. He enumerated past project funding by the Agency for International Development, Peace Corps' involvement with 380 volunteers working on water and sanitation, and the interest of U.S. professional associations and the private sector.

He stated that host country dedication to the provision of water supply was important and described the Brazil experience. He then closed by listing several recommendations as follows:

- A separate office in AID on Water and Sanitation be established, not to compete with Health, but to stand on its own merits.

- Water and Sanitation have a separate line item in AID's budget.

- More specialized staff be developed for this area.

- Permit major funding of water from the Food and Agriculture account since water is basic to rural development and productivity.

- Of AID's $200 million in water, only $8 million is in rural water and he suggested a large increase.

- Issue a short, one-page policy directive to the field indicating water as a top priority and encouraging Mission Directors to request water projects.

- Stress training, especially in Third World countries.

- AID should focus more on project design and use a hand pump that works.

D. Formal Presentations

A series of scheduled formal presentations provided additional information on water supply to the conference participants. These presentations were made on Monday, January 25 and Tuesday, January 26.

1. Evaluation Findings and Issues

Dr. Daniel Dworkin, Social Science Advisor, Bureau for Program and Policy Coordination, Office of Evaluation, Studies Division, presented a summary of the seven country evaluations and the policy implications. He reviewed the three-year evaluation process leading to the conference, and stated that the evaluations led to the following conclusions:

- AID should fund water projects primarily from the rural development account.

- Water projects should always be designed to be self-supporting preferably through direct payment of the beneficiaries or through some form of cross subsidy with urban systems.

- A community water group should be established to supervise the Agency efforts. This group should include engineers and social scientists and should be available for the review of all proposed water projects.

- All projects should require some measure of capital recovery from communities and aim for complete repayment, if feasible.

- Selected technology should always provide some improvement in the convenience of the supply, to assure community support.

- Health and hygiene education projects should be designed and implemented separately from water projects.
- Latrines and other excreta disposal projects should be designed and implemented separately from water projects.
- AID-funded research in community water supply should be clearly addressed to specific needs of the program.
- AID should set clear priorities for its work in the water sector. Projects to develop hardware may require too much of the limited available staff time.

2. Alternative Views Panel

A three-person panel presented additional policy and evaluation material. Dr. Blue served as the panel moderator.

F. Eugene McJunkin, Chief of the Water and Sanitation Division, ST/HEA, reviewed several studies on the effect of water supply on diseases. An early 20th Century study in the United States indicated a 65 percent reduction in typhoid as a result of improved water supply. McJunkin noted that as cases of typhoid decrease, the source of further infection also decreases. The actual level of water service, not water service per se, can affect health. He introduced material on comparative costs for supply and noted the importance of trained manpower, stable institutions and planning at regional and national levels.

Maureen Lewis, Economist, PPC/PDPR/HR, reviewed the development of the AID health policy paper. She recommended that the full range of benefits be addressed for water supply development. AID water projects should be developed where there is demonstrated need, a willingness to participate by the community, and community contributions to operations and maintenance costs. She addressed issues of appropriate technology, site specific surveys, community participation and financing.

Steven Sinding, Chief of the Office of Health, Population and Nutrition, USAID/Manila, stated that the Asia Bureau had observed that infant mortality was not affected by water supply development as much as other health interventions. He agreed that water supply development was important and that a separate funding account for water would be desirable. He stated that we should go beyond retrospective evaluation to address the question of what will work. The willingness of communities to act is important to project success.

Dan Dworkin stated that the water quality improvement of many projects is not sufficient to affect health. He stated that health education is a long-term investment and to link up with water projects is not appropriate.

Gene McJunkin stated that different environments require different systems. The desert setting makes human waste disposal relatively easy. He felt that health education has very little effect on water supply development and that the U.S. and Europe water development experience was accomplished without a health-oriented staff.

A question/answer period followed and was moderated by Dr. Blue. Ray Isely of WASH/CDM noted that an increased quantity of water may affect health, latrines should be developed after the water supply has increased sufficiently, and that community participation is necessary.

Dan Dworkin noted that there should not be a lock step approach to water with latrines. In Chad, latrines were not necessary

Henry Merrill, Philippine desk, ASIA/PTB, said that the sacred cows should be carefully explored and would include health education, latrines, and the necessity of community participation. He advocated looking at the other benefits of water supply development and to look in harder economic terms.

Howard Keller, Public Health Advisor, ASIA/TR/HPHR, stated that user education is more relevant than health education. The user must know what to do with excess water and waste water.

Dick Blue noted that health education is poorly implemented and is given low priority.

Dan Dworkin felt that health education was inappropriate and noted, for example, that antismoking campaigns in the United States are not very effective.

Helen O'Brien, consultant, stated that antismoking campaigns do work and that the consumer should be educated.

Dworkin was asked if health education was a failure or was it that the programs were not good. He answered that if well-trained health educators are not available, then projects should not be undertaken. He felt that the Ministry of Education would be a more appropriate agency than the Ministry of Health.

Gene McJunkin thought that health education could be integrated in other health-oriented programs such as maternity care. Latrine development can be done by self-help and with water supply development, latrine development usually follows.

3. Shallow Well Development in Tanzania--C. J. Bonnier

C. J. (Kees) Bonnier presented his 12-year experience of developing shallow wells in Tanzania. He stressed the requirement that water supply systems be reliable. He estimated that approximately 75% of the water projects in Tanzania were not functional and that only 6% of the total population have access to safe drinking water. He felt that piped water supply systems were too costly and difficult to build and maintain. Shallow wells can be maintained and operated at a tenth of the cost of piped water supply systems. Mr. Bonnier presented slides which showed the setting for the water supply program and the equipment he developed. An unusual foot-powered (kangaroo pump) mechanism was developed for pumping water.

Mr. Bonnier had the following recommendations:

- Donor countries should recommend least-cost solutions.

- Simple and sturdy construction should be emphasized. Steel should be used in place of native materials such as bamboo.
- Constructions should be maintenance free.
- Simple gravity systems or sturdy hand pump systems should be used rather than complex piped systems.
- Water supply should permit the community to profit from the water and develop other activities such as gardens.
- Hand-operated equipment should be stressed over machinery which requires parts and gasoline.
- A maintenance-free hand pump with a 10-year life should be developed.

4. Appropriate Technology Panel

A three-person panel provided information and issues regarding appropriate technology. Dick Blue served as the panel moderator. F. W. (Monty) Montanari, Water Resources Engineer, NE/PD/ENGR, stated that appropriate technology is that which works and keeps on working. He saw potable water as a long-term goal and stressed that quantity of water is the short-term objective. The ability of the community to contribute to the cost is a factor which affects the choice of technology. Appropriate technology is a means to lead to improved quality and quantity of water.

Sharif El-Hakim, consultant, stated that the political climate, availability of funds, and maintenance problems were factors to consider in choosing appropriate technology. The local availability of materials can constrain the choice of technology. Appropriate technology should consider appropriate design, users of the technology, availability of trained personnel to maintain equipment, dependence upon imported materials, and the available distribution network for parts.

Herbert Caudill, Jr., Environmental Health Engineer, USAID/Quito, stated that engineering school teaches one to design appropriately to needs. In the Panama water project experience, appropriate technology included simplicity of constructions, materials available locally, comprehensible design, available expertise, economical, and ability to perform designed tasks. He felt that appropriate technology was not necessarily primitive. The Navajo tribe in Sweetwater, Arizona used solar energy. The Panama project has been very successful. The target was 300 projects and 400 were installed. The technology included PVC fittings and pipes, diesel and submerged pumps, and use of locally available equipment. Water tanks were constructed from concrete block and did not leak. This highlighted the fact that one should not reflect on the constraints of technology, but should go out and get the job done. Another example he cited was the exposure of PVC pipe to sunlight and that the pipe was still functional after five years.

A question and answer period followed. Mr. Bonnier was asked to explain more about the shallow well program. He stated that the wells were covered as opposed to wide and open. He felt that solar and wind power was not functional for Tanzania. Operations and maintenance should be accomplished out of local funds. He felt that equipment that was not maintenance-free was irresponsible to install. He stated that appropriate technology may not be cheap technology. If a cheap pump breaks down one may have to drive 300 kilometers to replace a simple part. He stated that the kangaroo pump lasts about three or four years. The depth of the shallow wells was from 50-100 meters.

E. Evening Presentations

In the evenings of the conference, informal presentations were made by the conference participants. Several of these presentations included slides and most focused on in-country experiences in water supply development. The following presentations were made:

Monday, January 25, 1982

Conference Room II

7:30-8:30 pm	Aref Baha-Eddin, Deputy Director, Water Supply Corporation, Amman, Jordan
	Boulos Kefaya, Engineer, National Planning Council, Amman, Jordan
	Topic: Regional Water Supply Development in Jordan
8:30-9:30 pm	Richard Scott, PPC/E, Washington, DC
	Topic: Open Wells in Mali

Lounge 3

7:30-8:00 pm	Dennis Warner, Director, WASH Project
	Topic: Lessons from Water Supply Evaluations
8:00-8:30 pm	Mohammed Ashmawy, Chairman, National Organization of Potable Water and Sanitary Drainage, Cairo, Egypt
	Hanna Youssef, General Manager, National Organization of Potable Water and Sanitary Drainage, Cairo Egypt
	Topic: Water Supply and Sanitation in Egypt
8:30-9:00 pm	Jim Bell, Water/Sanitation Specialist, Peace Corps, Washington, DC
	Topic: The Peace Corps Involvement in Community Water Supply

Tuesday, January 26, 1982

Conference Room II

7:30-8:30 pm	David J. Garms, Program Office, USAID/Malawi
	Film: Water Development in Malawi
8:30-9:00 pm	Eric G. Dunn, Advisor in Environmental Health, South Pacific Commission, New Caldonia, South Pacific
	Topic: Water Supply in the South Pacific
9:00-9:30 pm	Mr. Iskandar, Program Coordinator, CARE/Indonesia, Jakarta, Indonesia
	Topic: Community Water Supply in Java

Wednesday, January 27, 1982

Conference Room II

9:00-9:30 pm	Eric G. Dunn, Advisor in Environmental Health, South Pacific Commission, New Caledonia, South Pacific
	Topic: Sanitation Technology in the South Pacific

Lounge 3

9:00 -9:30 pm	Glenn Wagner, Director, Water and Air Research, Inc., Gainesville, Florida
	Topic: Water Supply in Brazil

F. Work Group Sessions

Each conference participant was assigned to one of six work groups which addressed the following topics:

Workshop	Topic
1	Planning, Implementing, and Evaluating Community Water Projects
2	Funding and Financing Water Systems
3	Utilization of Appropriate Technology
4	Assessing and Affecting Institutional Capability
5	Developing Systems that Communities Value
6	Determining Appropriate Components for Water Systems

At Conference registration, participants were asked to express their preference for topics. This information was used in assigning the work groups along with considering organizational affiliations to balance the work group composition.

Each work group was assigned a room for the duration of the Conference. Two Co-coordinators were selectedfor each work group to facilitate work group discussions and production of the topic papers. An AID/Washington and AID/Mission Co-coordinator was assigned to each work group as follows:

1. Robert Beckman, Deputy Director, USAID/Yemen
   F. E. McJunkin, Chief, Water and Sanitation Division, ST/HEA

2. Maureen Lewis, Economist, PPC/PDPR/HR
   Steven Sinding, Chief, H/P/N, USAID/Manila

3. F. W. Montanari, Water Resources Engineer, NE/PD/ENGR
   Jim Wilson, Faculty Development Studies Program , PM/TD/DSP

4. John H. Austin, Environmental Engineer, ST/HEA
   Herbert Caudill, Jr., Environmental Health Engineer, USAID/Quito

5. Joseph Haratani, Sanitary Engineer, NE/TECH/HPN
   Desmond O'Riordan, Director, Office of Urban Administration and Development, USAID/Egypt

6. Claudio Fortunato, General Engineering Officer, USAID/Yaounde
   Henry Merrill, Philippine Desk, ASIA/PTB

The workshop process permitted participants to become involved in the other topics. On Monday and Tuesday, the working groups reviewed issues, discussed findings and recommendations, and developed a draft topic paper. Drafts were distributed to all of the working groups to be reviewed during Wednesday morning. Comments were delivered to the originating working groups for revision of the draft topic paper on Wednesday afternoon.

The workshop procedure was a modification of the Delphi method which is based on peer review and subsequent revision of findings. The working groups were not bound by any specific guidelines other than to complete the topic paper and to utilize the total experience of the workshop participants.

A meeting of the coordinators was held daily. At the final coordinators meeting, the recommendations of the groups were discussed and key recommendations were identified.

G. Final Plenary Session

The final plenary session started at 10:00 am, Thursday, January 28, 1982. Seated at the head table were:

Joseph Wheeler
Acting Administrator
Agency for International Development

John Bolton
Assistant Administrator
AA/PPC

Robert Berg
Associate Assistant Administrator
PPC/E

Richard Blue
Chief, Studies Division
PPC/E/S

Robert Berg gave an overview of the three-year evaluation process and the conference. He described the workshop procedures and gave a synopsis of the Conference presentations. He stated that there were two policy issues that required clarification.

- Are community water projects a high priority for AID? Missions require an indication as to the level of priority.

- The evaluations indicate that the basis for supporting water interventions is broader than generally recognized. There are economic, health and political rationales in addition to the social welfare rationale that has been applied . . . to the detriment of the case for water projects.

Mr. Berg invited the work group coordinators to report their findings. The following presented a summary of the work group findings and recommendations:

1. Gene McJunkin
2. Maureen Lewis and Steve Sinding
3. Jim Wilson
4. John Austin
5. Joseph Stockard
6. Hank Merrill

Joseph Wheeler, the Acting Administrator, thanked the conference participants for their attendance and involvement at the conference. He asked several questions of the group and recounted his experience with water development in Jordan. Mr. Wheeler did not agree with Ambassador McDonald's recommendation that water be provided a separate budget line item and was in accord with the basic recommendations of the Conference. He stated that governments are facilitators and not providers of water.

Robert Berg thanked the participants and ended the meeting.

APPENDIX A

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